THE FEASIBILITY OF A UNIFIED ROLE FOR NASA REGIONAL DISSEMINATION CENTERS AND TECHNOLOGY APPLICATION TEAMS

FINAL REPORT

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By
Philip Wright Associates
Storrs, Connecticut 06268

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SUMMARY

Insights and recommendations arising from a seven man-month study of the feasibility of combining the NASA Regional Dissemination Center (RDC) and Technology Application Team (Tateam) roles to form Regional Application Centers (RAC's) are presented. The apparent convergence of the functions of RDC's and Tateams is demonstrated and strongly supportive of the primary recommendation that an applications function be added to those already being performed by the RDC's. The basis of a national network for technology transfer and public and private sector problem solving is shown to exist, the skeleton of which is an interactive network of Regional Application Centers and NASA Field Centers. The feasibility of developing and extending this network is considered and the detailed ramifications of so doing are discussed and the imperatives emphasized. It is shown that such a national network could become relatively independent of NASA funding within five years.

LIST OF ACRONYMS USED

AAMI -- Association for the Advancement of Medical Instrumentation

ACORDD -- Action Council of Regional Dissemination Directors

AEC -- Atomic Energy Commission

ARAC -- Aerospace Research Application Center

ASME -- American Society of Mechanical Engineers

BAT -- Biomedical Application Team

Bateam -- Biomedical Application Team

CDSIA -- Council of Defense and Space Industries Association

CPDC -- Connecticut Product Development Corporation

CY -- Calendar Year

DOC -- Department of Commerce

DOD -- Department of Defense

DOI -- Department of the Interior

DOT -- Department of Transportation

DRI -- Denver Research Institute

EDA -- Economic Development Administration

EIA -- Electronic Industries Association

EPA -- Environmental Protection Agency

FEO -- Federal Energy Office

FY -- Fiscal Year

HEW -- Department of Health, Education and Welfare

HUD -- Department of Housing and Urban Development

IEEE -- Institute of Electrical and Electronic Engineers

KASC -- Knowledge Availability Systems Center

LEAA -- Law Enforcement Advisory Agency

MARAD -- Maritime Administration

NAFAC -- Federal Aviation Facility

NASA -- National Aeronautics and Space Administration

NCSTRC -- North Carolina Science and Technology Research Center

NEMA -- National Electrical Manufacturers Association

NERAC -- New England Research Application Center

NERCOM -- New England Regional Commission

NIH -- National Institute of Health

NSF -- National Science Foundation

NTIS -- National Technical Information Service

RAC -- Regional Application Center

R. and D. -- research and development

RDC -- Regional Dissemination Center

RTI -- Research Triangle Institute

SBA -- Small Business Administration

SIC -- Standard Industrial Classification

SP's -- Special Publications (NASA)

SRI -- Stanford Research Institute

TAC -- Technology Application Center

TAT -- Technology Application Team

Tateam -- Technology Application Team

TRIS -- Transfer Research and Impact Studies (Denver Research Institute)

TU -- Technology Utilization

TUO -- Technology Utilization Office

WESRAC -- Western Research Application Center

OVERALL OBJECTIVES OF THE STUDY

The objective of this study has been to examine the possibility of creating a national interactive network of technology application centers sponsored by the National Aeronautics and Space Administration (NASA), each center being formed by combining the currently separate functions of the NASA Regional Dissemination Centers (RDC's) and the NASA Technology Application Teams (Tateams), the resulting unit being what has become known as a Regional Application Center (RAC).

Particular efforts have been made to:

- --determine what additional services and application assistance might improve the current functioning of RDC's and Tateams and thus enable them more effectively to serve the technological needs of the private and public sectors
- --examine the potential need for RAC services to federal regional offices and outline how a mutually supportive relationship might be established
- --outline a methodology for preparing regional profiles of industrial and public sector needs for use in matching NASA technology to public and private sector problems
- --develop a problem identification and definition technique for use by the RAC's which will permit RAC network problem-solving
- --determine the feasibility of combined RDC-Tateam roles operating as a network and prepare a structural outline and development plan for such a system

--provide long-range recommendations for network operation and expansion including interaction with other federal agencies, funding alternatives and the ultimate role for NASA within the total network.

TECHNOLOGY AND THE STATE

The support and encouragement of technological advances in the public interest has been practised by national governments in one form or another for centuries. There may have been disagreement, as now, about what the public interest was, and how it should be served, but it is inescapable that the drive for power of the nation state, either military or economic was and still is inseparable from the successful development and utilization of science and technology.[1/]

The Romans built roads, aqueducts and granaries 'pro bono publico'; the Middle Ages saw the growth of both public and private patronage of inventors and the like; the British Statute of Monopolies in 1628 which established British patent law was, in fact, a contract between the Crown and the patentee under which the Crown granted the patentee a sixteen year monopoly in making or using the invention in return for a disclosure to the public of the invention and how to put it into practice.[2/]

Napoleon relied on science and technology, organizing and funding both research and training so that knowledge was available to serve the state.[3/] Under Bismarck in Germany, "German industry was subsidized and protected by the state...(and)...the factory was looked upon as a battlefield and the industrialist as a field commander."[4/]

Organizing for technological progress in the United States began slowly. There was some early public and private support for science and technology but the move west by the pioneers "required organized

technology to aid and sustain them and...farmers, ranchers, and miners turned to the Government for help."[5/] The Department of Agriculture was established in 1862. The U.S. Geological Survey, established in 1879 was based on a plan for the exploitation of the Rocky Mountain West.[6/]

One of the first conscious decisions by any government to acquire, disseminate and utilize modern technology for the benefit of the state occurred in Japan. "The decision to modernize Japan, which was made at the time of the Meiji Restoration in 1868, was accompanied by a deliberate government policy of acquiring science and technology."[7/] After World War II, the Japanese government was very prominently concerned with the acquisition of non-Japanese technology and all Japanese companies seeking agreements for access to new technology had to obtain the approval of both the Ministry of International Trade and Industry and the Bank of Japan. "This need for approval gave the government a powerful lever to control the flow of technology into those branches of industry which it felt were most in need."[8/] In addition, the Japanese government has sponsored official missions overseas to survey the level of technology in a given field and to make recommendations about what should be acquired.[9/]

Other countries, since World War II, notably, Canada, France, West Germany and the United Kingdom, have felt the necessity for their governments to support "technology enhancement programs, which are designed...to promote invention and innovation and the development, transfer and utilization of new technologies."[10/] One important aspect

of these programs has been to boost invention and innovation and, as important, to stimulate "the commercialization of research findings that are in the public interest and appear to have good industrial potential."[11/] All these countries as well as Japan, have established special agencies specifically to "evaluate research findings, primarily of government research laboratories and institutes...(and)...underwrite part or the full cost of developing a new technology or product and require re-payment of their investment plus the payment of royalties only in the event the venture is successful."[12/]

One important point that requires emphasis about all programs is the nature and quality of the relationship between the government and industry. "Open channels of communication and mutual trust between representatives of government agencies and the private sector are essential."[13/]

In the United States, both NASA and AEC are currently supporting active efforts to underwrite development and commercialization of the new technology created by their own missions, namely space-derived R. & D. and atomic energy. Pilot transfer efforts by some DOD laboratories have also occurred. A limited number of programs in MARAD, NIH, DOT, EDA, and SBA have dabbled in the subject but "most of these...have been initiated by the individual agencies concerned and do not indicate the kind of national policy or commitment that the U.S. space and atomic energy programs indicate."[14/]

A recent report to Congress from the Comptroller General of the United States recommends "the establishment of a centralized interdisciplinary

team of senior professional scientists and engineers who could cross agency lines to assist both generating and using agencies to identify and selectively match potential users with technology. The success of the NASA...leads us to believe that some of the concepts used... could be successfully applied on a government-wide basis..."[15/] Further emphasis and impetus has been provided by a National Academy of Engineering recommendation that the U.S. government should increase "the funding for application, adaptation and utilization to at least the same level as that expended for information collection and dissemination; namely about $1 billion."[16/]

CONVERGENCE OF RDC AND APPLICATION TEAM FUNCTIONS

General

NASA's active involvement in efforts to secure the secondary utilization of space-derived technology started more than 10 years ago.[17/] All aspects of this program stem from the mandate contained in the National Aeronautics and Space Act (as amended) which states that NASA shall "...provide for the widest practical and appropriate dissemination of information concerning its activities and the results thereof."[18/] The NASA Technology Utilization Program represents the present practical embodiment of this mandate. Over this period of ten years, five relatively separate and distinct networks of involvement in NASA technology transfer and utilization have evolved. These are:--

(a) Regional Dissemination Centers, providing paid-for technical information services to clients, mostly in the industrial sector.

(b) Technology Application Teams operating in a problem-solving mode in restricted fields of subject matter such as Biomedical instrumentation, transportation, etc.

(c) NASA Field Centers with resident expertise in science and technology, the existence of which, of course, pre-dated that of the Technology Utilization program.

(d) NASA Patent Counsel at headquarters and the Field Centers, responsible for administering and implementing the NASA patent licensing and waiver programs.

(e) The Technology Applications Program of the NASA Office of Applications concerned with the application of NASA systems integration capability across Field Center lines to achieve systems level solutions to major problems.

For the purposes of this study and as a justification for its primary recommendation, it will suffice to mention the main chronology of the development and implementation of two major components of the Technology Utilization Program, namely, the RDC network and the Application Team network, how they have involved the Field Center network during this time, and how there is a perceptible convergence in their technology transfer modes of behavior which now should be blessed with recognition and implementation.

Regional Dissemination Centers (RDC's)

The first RDC was established in 1963 at Indiana University--appropriately named the Aerospace Research Application Center (ARAC).[19/] This information for industry service was computerized on the basis of the so-called NASA tapes, and ARAC was essentially"...to attempt to ferret out industrial benefits from the multi-billion dollar U.S. investment in space research...(and)...to attempt to facilitate this 'spin off' of scientific knowledge by pinpointing the advances that industry would like to see and then checking whether space scientists already have attacked the chore."[20/]

It was thought that the space program would promote economic growth in a number of ways:

--increasing labor productivity

--generating new consumer products and new variants of old products

--stimulating new demand, creating new markets and thus encouraging capital formation

-affecting significantly certain industries, particularly communications and transportation

-improving managerial knowledge and management techniques particularly in research and development

-assisting state and local governments in their numerous and costly service activities, for example, highway building and traffic control.[21/]

The potential benefits to industrial clients of ARAC were hypothesized (since this was an experimental project) to include:

-priority access to new ideas, information and concepts

-participation in panel discussions of experts

-access to NASA technical personnel

-access to ARAC's computer services, technical library and other facilities related to ARAC's programs

-access to university personnel[22/]

Proliferation of RDC's took place within the next four years and by April 1967, allowing for drop-outs, the RDC network comprised:

Aerospace Research Applications Center (ARAC), Indiana University

Knowledge Availability Systems Center (KASC), University of Pittsburgh

New England Research Application Center (NERAC), University of Connecticut

North Carolina Science & Technology Research Center (NCSTRC), State of North Carolina

Technology Application Center (TAC), University of New Mexico

Western Research Application Center (WESRAC), University of Southern California[23/]

The drop-outs were in part caused by a 1966 decision by NASA Headquarters that each RDC should become financially self-supporting as soon as possible

or at least demonstrate substantial progress toward that goal. This edict had a secondary effect of forcing a diversification of the RDC's information base since it had already been demonstrated that the RDC market needed responsive, relevant and applicable information which was not always to be found in the NASA information resource. It is clear now that this decision was based on a perception that the RDC network must ultimately become a national resource to be 'spun-off' at the appropriate moment as a self-supporting entity. This, in itself, demanded a 'one-shop-stop' approach to the provision of information services, the first criterion for the success of which was customer satisfaction.

This information resource diversification has now culminated in the acquisition by the RDC network either directly or indirectly of around two dozen computerized files. Typical of the current resources are:

File	Coverage	Present Size	Monthly Growth Rate
Abstracted Business Information (ABI)	Aug. 71-present	10,000	1,000
American Society for Metal (ASM)	1966-present	150,000	2,000
Bio Sciences Information Systems (BIOSIS)	-	700,000	140,000
Chemical Abstract Condensates	July 68-present	1,500,000	30,000
Chemical Market-Predicasts	Feb. 72-present	40,000	10,000
Education Resources Information Center (ERIC)	Present	150,000	2,000

File	Coverage	Present Size	Monthly Growth Rate
Engineering Index Compendex	Jan. 70-present	300,000	7,000
Food Science & Technology Abstracts (FSTA)	1972-present	25,000	1,700
Gov't. Reports Announcements (NTIS) (GRA/DDC)	GRA 1970-present DDC 1964-present	250,000	5,000
Infrared Spectral Information System (IFIS)	1966-present	92,000	
INSPEC (Physics, Electrical Electronic & Computers)	1969-present	450,000	6,000
Institute of Scientific Information (Science & Social Science) (ISI)	July 73-present	225,000	40,000
Institute of Textile Technology (ITT)	Jan. 66-present	60,000	1,000
Massachusetts Institute of Textile Technology (MIT)	1950-1967	10,000	
Medline (Aspects of Medicine & Pharmacueticals)	1970-present	2,000,000	20,000
National Aeronautics & Space Administration (NASA)	1962-present	1,000,000	5,000
National Agricultural Library (NAL/Cain)	1972-present	220,000	10,000
New York Times Index	May 69-present	800,000	16,000
Pandex			
Psychological Abstracts	Jan. 67-present	120,000	2,000
Transdex		55,000	500
World Textile Abstracts (WTA)	1970-present	30,000	7,000 [24]

At the present time, all RDC's are contractually enjoined by NASA to:---

(a) use best efforts to solicit fee-paying clients for services involving the selective provision of scientific and other information included in the National Aeronautics and Space Administration information resource materials made available for this purpose

(b) Add to and expand the information resource from other available sources likely to be useful to clients

(c) establish the price of individual services offered according to the cost of providing such services

(d) use discretion in the development of services appropriate to the needs of the markets served

(e) analyze the effectiveness of marketing efforts and assess market penetration as well as client utilization of the services provided, with the goal of determining optimal marketing policies and practices, and the economic benefits resulting from the services provided

The services generally available from RDC's include:...

(a) Custom and proprietary information services for individual clients using the information resources referred to above. These services basically consist of retrospective and current awareness searches including:

(1) pre-search analysis of posed questions and preparation of search strategy by a staff specialist or a consultant;

(2) computerized or manual information retrieval from the information resource;

(3) post-search analysis by a staff member or consultant;

(4) delivery of abstracts or documents selected for relevance to the user;

(5) provision of hard copy or microfiche, when requested; and

(6) interpretive or advisory liaison and service as requested and feasible, concerning the use of the information provided.

(b) Standardized information services and products for groups of clients or special user communities. These services and products are generally oriented to specific subjects or subject

areas having wide appeal to a broader market.

(c) Dissemination and assistance in the interpretation of of special forms of data and information relating to aerospace and other technologies. Such special forms of data include photographic imagery, digital and other computer data, and computer analysis programs.

(d) Conferences, short courses, demonstration projects and other special activities and application projects which improve the process of transferring NASA and other technology or lead to a better understanding of a particular technology's transfer potential. [25]

The present outreach of RDC activities, particularly in the industrial sector is not inconsiderable. In 1973 service was provided to more than 3,000 clients. [26] Income earned by the provision of information services by the entire RDC network was about $550,000 in 1972, $650,000 in 1973 and a projected $860,000 in 1974. The return on each dollar invested by NASA in RDC activities has risen from 81 cents in 1972 to a projected $1.05 in 1974. [27] In fact, the RDC network provides NASA with its primary--and probably only--interface with non-aerospace industry. There is, however, considerable evidence to show that the RDC's are being forced into more than the provision of a technical information service and a consensus of RDC views is clearly reflected by the acknowledgment by one RDC director that a useful development of RDC services to industry"...would be the provision of a recognized procedure and supporting funds to enable people within a NASA Center to discuss with people in industry new applications for NASA technology, and to supplement these discussions with limited laboratory investigations. Some RDC's might wish (or need) to increase their staffs to provide a reasonable in-house engineering capability to help industry define its problems and search

within organizations as well as in the literature for new technology solutions, At our Center, most of the staff is competent in specific areas to do the kinds of things that BAT and TAT members do and would enjoy doing them."[28/]

Biomedical and Technology Application Teams

In response to a perception in the mid-sixties that the NASA T. U. Program was characterized as one where too many solutions were chasing too few problems, an experimental program to define problems and solutions was begun. This Application Team experiment, conceived in 1965, sought to accelerate the transfer of aerospace technology to the non-aerospace user through the use of an active 'coupler' mechanism.[29/] The Technology Application Teams themselves constituted the 'coupler' mechanism and sought both problems and solutions, actively. They were comprised of small groups of professionals from a variety of disciplines, located at various research institutes. These teams met investigators to define their problems and to try to locate potential solutions by searching the NASA information system. The teams, therefore, provided an interface between a problem from one research area and a potential solution from a quite different research area. The research area studied initially was biomedicine and the original Biomedical Application team experiment tested and verified these hypotheses:

- ..Biomedical researchers are receptive to new technology and would adapt it if it were available and within their resources.
- ..The flow of aerospace technology to applications in biomedicine can be accelerated.

..A multidisciplinary interface between the NASA aerospace data bank and biomedicine, using a systematic experimental methodology to identify and relate technical needs with potentially applicable aerospace technology, offers an effective means for translating this singularly oriented mission information to a new mission such as biomedicine.

The general objectives of these Application Teams were:

..To identify significant public problems and needs existing in the problem areas studied which appear to be 'solvable' by application of aerospace technology.

..To seek out and identify specific aerospace technologies or concepts which may lead to solution of these problems.

..To assist problem originators, as appropriate, in the application of these techniques to their problems.

..To document successful application of aerospace related technology by researchers as a result of their participation in the Application Team Program.

..To operate participatively on the basis of personal interaction in order to gain user interest, cooperation and acceptance of the concept of the transfer of technology from one discipline (say, communications technology) to another (say, the provision of health care over a substantial geographical area).

By January, 1969, three Biomedical Application Teams (Bateams) were working with investigators in 19 different medical research organizations.[30/] An independent examination of the program was made in the same year and six major areas of concern as expressed by the program's participants included an inability to obtain or develop hardware.[31/] For example, although the initial methodology employed by the teams in effecting technology transfer was in general similar, some ambiguity in the definition of terms and in the establishment of the end-point of activity in any particular transfer situation caused difficulty. One Bateam stated that "the methodology... consists of four basis basic steps: problem

definition, identification of relevant technology, evaluation of relevant technology, and documentation", [32/] but a breakdown of these showed that the final step in the transfer process was "...the implementation and experimental evaluation of potential solutions." The team was "...available for assistance in this step when required." When a potential solution was shown to be viable, "...hopefully...this solution is adopted by the problem originator and the transfer is complete." [33/] However, it was recognized that an effective Bateam-industry interface was necessary to overcome "constraints on the development and marketing of medical equipment." [34/] The implication here is a recognition that the ultimate end-point of the transfer activity is an involvement with the private industrial sector. This recognition became more explicit as time passed and also as a result of increased public interest in the potential use of aerospace technology to solve other pressing social problems. This led to an expansion of the Application Team Program into such public problem areas as air pollution, water pollution, criminalistics and law enforcement, urban construction, transportation, and mine safety.

By 1972, concern with industrial participation in application team projects had become explicit. The Southwest Research Institute Bateam reported that "a serious problem exists in terms of encouraging industry to assume responsibility for making innovations developed under the program available to those that need them. New mechanisms are needed to induce industry to take an active role in the technology

utilization process."[35] The SRI Technology Application Team, concerned with public sector problems in the transportation field stated in 1973 that it had"... recognized that commercial businesses must enter the process in order to transfer technology successfully. The Team member acts as a third-party transfer agent, interacting with the people who can define public sector technological problems, the NASA scientists and engineers who can bring technology to bear on these problems, and the businessmen who can convert the technology into products that solve problems within the technical and economic limitations imposed by the market."[36] As a result, the team"...has developed a methodology that includes adaptive engineering of the aerospace technology and commercialization when a market is indicated."[37] Similarly, Abt Associates, involved as an application team in urban construction reported that it intended"...to develop a general methodology that will enhance overall industry participation. In addition, we plan to introduce industrial participation at the earliest stages of the innovative process and to focus industrial participation on the areas of problem specification and applications engineering. As a corollary, we will attempt to identify and weigh the factors involved in the private sector's decision to participate in the NASA technology transfer process. At a minimum, our design must accomodate the decision process of the private firm. It must involve estimates of (1) the probability of technical success; (2) the cost of development; (3) the time of development; (4) the probability of commercial success; and (5) the expected return to the firm."[38] Another area of concern in the 1969 examination of the Biomedical Application Team

program was the inherent limitations in the NASA data base.[39/] To begin with, there were essentially two approaches to the identification of technology responsive to the solution of specific problems. These were manual and computer searches of the NASA data bank and direct contact with the professional staffs in NASA Field Centers by the circulation of problem statements. However, it was early found that by sometimes establishing direct contact between the problem originator and NASA Field Center Staff, that"...the transfer of information between NASA and the medical field becomes more direct. The more direct the transfer, the more relevant, accurate and complete is this transfer."[40/] Contact with and access to Field Center personnel increased over the years and this was stimulated by the discovery of variable results from computer searches depending upon the manner in which the search strategy is designed. There was concern that"...there are a few circumstances under which one can be certain he has obtained all the pertinent information on a given topic."[41/] Direct contact with Field Center personnel was established by arranging"...team visits to centers to gain a better understanding of center activities so that problem statements can be sent only to those centers with high probabilities of responding...in addition... specific projects of interest often are presented during these visits."[42/] By 1973, this same team (RTI) reported"...this is the first reporting period since the inception of the team in 1966 that no problems were solved using literature searching...(and that)...for the past three years, the direct interaction with the Field Center has accounted for approximately 90% of the solutions to problems..."[43/] Other teams reported along the same lines. "Development of improved techniques for more adequately tapping the expertise available within NASA research

facilities continues to be a matter of prime concern. This is because a large amount of technology remains in the minds of NASA engineers or scientists, never appearing in a technical paper or report, which have been the mainstays of the problem solution effort. More extensive and effective interpersonal interaction is clearly needed to capitalize upon this valuable asset. To this end, the team proposes to station a team member at the lead center for biomedical activities, for full time duty. This will facilitate development of the interaction needed with resident scientists and engineers."[44/] "Much of the success of this second year's work was the result of an ability to pinpoint NASA expertise, present the problem on a person-to-person basis, and show down-to-earth relevance to a scientist's mission. The Team was thereby able to reduce the time from problem origination by the user to presentation of a potential solution. Again the user's confidence in the program was increased. Furthermore, it became evident that NASA Field Center personnel were developing confidence in the Team as a result of personal interactions regarding matters of public sector concern and appreciative feedback by user agencies. On many occasions we have received unsolicited information from a scientist, information he thinks may be applicable in the team's mission area. For example, Ames Research Center personnel brought their work on brake lining materials to our attention as a possible solution to problems in transportation and the postal service vehicle fleet."[45/] "...in technology reconnaissance...personal contacts produce the best results...(so)... the team intends to expand expertise searching activities by making in-person presentations of problem parameters at several NASA centers..."[46/]

The general effect of this tendency to rely on Field Center contact for problem solving has been to bring NASA technical professionals actively into the arena of technology transfer and in the limit, for some NASA centers to examine and evaluate the responsiveness of their own in-house skills and expertise to public sector problems in general. This in turn has resulted in their responding to requests for proposals initiated by the NASA Headquarters T.U. Office and addressed to the solution of a variety of public sector problems. In some cases unsolicited proposals have been made. Contracts have been negotiated, funding provided and work is (FY 74) in progress (in some instances, completed) in the areas of biomedicine (cardiology, instrumentation and systems analyses, rehabilitation) environmental pollution, transportation and mine safety, urban construction and safety and state and local government problems. In FY 74 Field Center Applications Engineering project funding exceeded that for Regional Dissemination Centers and for the Application Teams, and this trend will continue.[47/]

In summary, therefore, the convergence of RDC and Application Team modes of behavior is demonstrable...in problem solving, in using Field Center expertise, in serving the public interest and in providing service to and involving in specific projects, private industry. The time has come when this convergence should be recognized and made explicit by the formation of Regional Application Centers (RAC's).

THE GENESIS OF THE CONCEPT OF THE REGIONAL APPLICATION CENTER

The emergence of the Regional Application Center as an approach to more effective transfer of NASA technology to both private and public sectors occurred during 1972 and 1973. Numerous informal discussions among the senior Technology Utilization Office Management staff--from the Assistant Administrator to Division Director and project management levels--centered around integration of the T.U. Program and NASA Field Center resources as means for accelerating the application of technology to industrial, commercial and public problem areas, provided a setting in which many alternative approaches could be developed. Dr. Low's emphasis on placement of technical project management responsibility at the Field Centers rather than at NASA Headquarters served to stimulate the exploration of ways in which Field Center expertise and facilities might better serve the Agency's technology transfer effort. During this period, consideration was also given to the various roles of NASA's Regional Dissemination Centers and Technology Applications Teams as 'out-reach agents' for the T.U. Program. Budget constraints and funding commitments for the RDC, TAT/BAT, Applications Engineering and Information Dissemination Programs served as a stimulus to the search for new ways to expand the total T.U. effort and productivity through innovations in program management.

A number of studies and reports (see bibliography) over the past four years have provided outside perspective and encouragement to Federal Technology transfer, particularly in the areas of public concern--

transportation, environment, safety, health/medicine, and most recently, food, resource conservation, and energy. Accessibility of Federal technologists, technology and facilities to state and local governments has become a matter of interest to many as revenue-sharing placed resources for 'problem-solving' closer to the tax-payer. The termination of the war in Southeast Asia, coupled with a concern by the public and Congress with the economic and social state of the nation, has created opportunities--and in certain areas, mandates--for a realistic federal application of existing technology to solve problems rather than the development of new technologies to meet future needs. NASA's T. U. Program found itself in the unique and somewhat contradictory position of being the best equipped and experienced federal technology transfer program, located in an agency whose primary mission had only marginal relevance to the areas of immediate public concern but whose broad capabilities in developmental and applied technology were foremost among all federal agencies but at a time when the NASA budget was declining as expenditures for economic and social 'problem-solving' were rising.

Thus the 'givens' on which the Regional Application Center concept evolved were:

--an increased public and Congressional interest in the use of technology to meet urgent national needs

--local-level--i.e., state and city--pressure to offset inflationary costs and provide solutions to increasingly complex problems through the introduction of 'hard' and 'soft' technology

--a decreasing NASA budget and a reduction in the number of advanced development projects and programs

--a Technology Utilization Program with ten years of experience in technology transfer, a variety of somewhat independent transfer mechanisms, communication channels involving Field Centers, contractors, semi-autonomous centers and specialized adaptive engineering teams, and a well developed but separate technology publications and dissemination capability.

In this setting, any potential T. U. alternatives could be explored in an attempt to address critical needs in the public sector, with particular emphasis on a broadened use of T. U.'s "transfer agencies"--RDC's and TAT/BATs at the delivery or demand end of the system and an increased involvement of Field Center technologists at the supply end. Several individual approaches coalesced into a network concept, which came to be referred to as the 'Regional Application Center' or 'RAC' approach--since it involved to a certain degree a merger and sharing of roles and resources by both Regional Dissemination Centers and Technology and Biomedical Application Teams.

The Regional Application Center concept is based on five key premises:

--an essential factor in the transfer of technology, especially for technology to be applied to problems in the public sector, is the active, person-to-person interaction of technologists and ultimate 'users' or appliers of the technology

--the breadth and depth of NASA's technological potential are

reflected in the sum total of its technologists and existing technology

--'users' of technology, particularly private and public sector organizations with problems or needs to which technology can be applied, rarely take the necessary initiatives, not knowing the technology exists or that it can be usefully and economically or profitably applied

--technology, in its original form, is difficult to market. It requires adaptation and repacking into specific products or uses, applications or market analysis to identify user populations, advertising to create user awareness and ultimately personalized selling and assistance to the user in applying the technology to meet his need.

--The NASA T. U. Program has among its component parts, the elements of a national network capable of providing users with not only access to NASA Field Center technologists and their technology but an application assistance capability, dispersed in a regional manner.

--Thus, a latent network, or the building blocks for such, could be shown to exist. There are now;

--13 NASA installations in nine states and the District of Columbia

--6 NASA/TU sponsored Regional Dissemination Centers located in the northeast, mid-Atlantic, southeast, central, southwest and west coast regions of the country

--7 T. U. sponsored Application Teams established and operating in five of the ten federal regions (the seventh was recently established in Wisconsin)

--A NASA/TU program evaluation and support project in Denver, Colorado

These 27 active elements of NASA's technology Transfer Program provide access points for technology users in 17 of the 50 states and the District of Columbia. They are strategically located near the largest industrial and urban centers of the U.S. and to the Headquarters offices of the Federal agencies. Effectively connected and coordinated they could provide an invaluable interface between the various sources of NASA technology and regional/local needs.

METHODOLOGY & WORK ACCOMPLISHED

The start of the study involved an extensive round of discussions with officials of the Technology Utilization Office in NASA Headquarters in Washington, D.C. These discussions established that field survey interviews with the TU program participants and representatives of the public and private sector, who had an actual or potential involvement with the TU program, would most usefully contribute to the realization of the objectives of the study. One outcome of these discussions was the preparation of a series of position papers related to salient aspects of RDC activities. Copies of these can be found in Appendix A (page101). They were used as a basis for discussions at a joint NASA TUO HQ-RDC directors meeting in New Orleans, in January, 1974 and covered the following subjects:

- --Marketing
- --Incentives
- --Marketing Territories
- --Client Follow-up
- --New Product Lines
- --New Services
- --The Network Concept
- --Communications and Project Management Needs
- --Prices of Services

They also served as an excellent entry point for individual discussions of the RAC concept with RDC directors at later dates. Arrangements were also made for individual interviews with Application Team Directors, various and sundry public sector officials and the directors and staff of the TRIS project at the Denver Research Institute. In total the number of people whose views were sought amounted to about

seventy. Their names, titles, affiliations and addresses and telephone numbers are listed in Appendix B.

An abbreviated sequential account of work done follows:

January, 1974 — Discussions with NASA HQ TUO staff were held and the RDC position papers referred to above were drafted and discussed. Subsequent procedures were agreed to with the Technical Monitor and a preliminary check list of questions and issues compiled. A test of this check-list was made in a series of interviews with the director and staff of the Knowledge Availability Systems Center (KASC) at the University of Pittsburgh. Initial contact was made with the New England Regional Commission (NERCOM) about items 3. and 4. in the Work Statement--namely, the need for Regional Application Center services and a methodology for preparing regional profiles. In addition, a review of Region 1. industrial data was started, together with a review of space R. & D. expenditures in the areas of primary concern.

February, 1974 — The New Orleans meeting of the Action Council of Regional Dissemination Directors (ACORDD) and representatives of NASA H.Q. TUO was attended 2/12/74-2/15/74. Individual discussions with RDC directors, NASA representatives, the Director of the Research Institute Triangle (RTI) Bateam, and Neil Ruzic and Company were useful in clarifying for them the purpose and thrust of the Regional Application Center Feasibility Study. The ACORDD meeting was generally agreed as to the usefulness of the position papers, first drafts of which were made under this contract. In an effort to establish the nature and ramifications of a State effort to transfer and develop technology for the economic benefit of the State, discussions were held with the Executive Director (Mr. K.E.V. Willis) of the Connecticut Product Development Corporation (C.P.D.C.). Follow-up discussions after the

New Orleans Acordd meeting were held with various NASA H.Q. TUO officials during the week beginning 2/25/74. It was generally concluded that the feasibility investigations were proceeding satisfactorily. A joint meeting was held with the Director of the North Carolina Science and Technology Research Center (Mr. Peter J. Chenery) and the Research Triangle Institute Biomedical Applications Team (Dr. Thomas Wooten).

March, 1974

A visit was made to the Aerospace Research Application Center (ARAC) at Bloomington, Indiana for discussions with the Director, the Dean of the School of Environment and Public Affairs, and various members of the ARAC staff. Of particular interest was the ARAC effort to associate itself with the American Public Works Association in securing NSF funding for development work by a NASA Field Center directed toward the solution of public sector problems concerned with refuse collection and street cleaning.

Discussions were held with a representative of an RDC client (G.D. Searle, Inc.). Considerable interest was shown in the various applications engineering projects being sponsored by NASA HQ TUO and various possibilities were explored for the company to associate itself, through its RDC membership, with one or more of these projects.

A meeting was held with staff members of the New England Regional Commission to talk about Federal Regional 1 industrial profile data sources and technical/scientific advisors in each of the six Region 1 states.

A review was made of the economic, industrial, municipal and state reports for private and public sector profile data.

A survey was started of the structure of all Federal offices in Region 1 to identify possible points of contact for detailed discussions of the RAC concept.

In order to obtain information about possible interfaces with RAC's, one session was attended of an LEAA-sponsored training programs of Law Enforcement Science Advisors--field agents for law enforcement technology.

A search on the subject of Information Networks was completed and a review of it started.

A discussion of Application Team activities and information was held with the manager of the Application Team at Abt Associates in Boston, Massachusetts.

A meeting was held with the Director of Planning, Massachusetts Department of Environmental Affairs on the subjects of technical information dissemination, interaction with the Federal agencies(e.g., EPA) on the technological matters of interest to Massachusetts state agencies, and a possible relationship with the RAC network.

April, 1974

Meetings were held with Denver Research Institute's Transfer Research and Impact Studies (TRIS) project director and senior staff to explore the Regional Application Center concept in depth and to examine possible approaches to the construction of regional profiles for use in the development of RAC marketing strategies. DRI/TRIS staff included Dr. C. Heins (director), J. Freeman, W. Hildred, and D. Johnson.

A meeting was held with G. Sahady, staff economist of the New England Regional Commission to identify state-level contact points for further regional public sector profile development.

Contributions were made to a NASA HQ TUO meeting to consider the pros and cons of transferring RDC contracts to NASA Field Center management.

Meetings were held with the Directer of the Technology Application Center, (TAC), University of New Mexico and members of his staff. There was an extensive series of

discussions about the RAC concept. Subjects covered were:

--Need for applications assistance and additional information resources to better serve clients

--Need for improved communications with sources of special information and 'know-how'

--The relationship between Federal Regional offices and the Federal Regional Council

--The usefulness of a profiling technique for pinpointing opportunities in both the public and private sectors

--Possible problems and some necessary prerequisites in handing over RDC contract management to Field Centers

--Regional and state problems uncovered by a recent TAC study

--TAC's targets

--RAC funding possibilities

Preparations were made to lead a Nasa review of the RAC concept to take place on 9 May, 1974. Subjects covered were:

--RAC organizational structure

--Field Center role

--RAC objectives (private and public)

--Funds

--Cost sharing

May, 1974

Meetings were held with state government officials in three of the five northern New England states to discuss technology transfer,

information services, problem identification, and the possibility of the RAC concept. These comprised:

> Professor Charles Tarr, University of Maine, Orono, Me.--technology based economic development programs at the state and local levels, involving the state university system.
>
> Mr. Bernard Johnson, Director of the Vermont State Planning Office--points of entry for RAC services that exist in state government structure.
>
> Dr. Halsey Smith, Director of the Center for Research and Advances Study, University of Maine, Portland, Me.--aspects of 'Project New Enterprise' and the 'Incentives for Innovation Program' conducted jointly with M.I.T. and funded by N.S.F. These projects aim to upgrade and stimulate Maine industry by introducing new technology and by relating the respective roles of the state government, the university and industry in technology transfer.
>
> Professor Owen Durgin, Resource Development Center, University of New Hampshire, and Mr. Henry Bourgeois of the New England Municipal Center, Durham, New Hampshire--how local needs in the six state New England region are identified and how assistance is supplied and might be expanded along technological lines.

Follow-up discussions were held with Edmond Howie and Allen Kent (KASC, University of Pittsburgh). The RAC concept was further developed and a tentative special project between KASC and NASA/Lewis to obtain greater regional exposure for Lewis technology was outlined.

Further consideration was given to a special project for TAC (University of New Mexico) to test the need of Federal Regional offices for an information services.

A presentation was made to NASA HQ TUO management on suggested aspects of RAC's and their ultimate development into a national network for technology application.

Background reading in anticipation of the final report continued and work on the report itself started.

Meetings planned with DRI/TRIS staff and West Coast Application Team and RDC directors met with scheduling difficulties and were temporarily postponed.

June, 1974

Steady progress toward the finish of this project continued and the final report writing was well advanced. However, it was deemed prudent to seek a six week, no-cost extension to the period of performance to properly accomodate the conclusions of a Denver TU meeting in July.

The principal thrusts of the work were:

--Summarization of data and information obtained in connection with RAC market profiles in the public and private sectors.

--Continuance of background reading and work on the final report.

--The drafting and delivery of a project plan for the first phase of RDC network expansion--in conjunction with NASA TUO officials. Subjects covered were:
--Introduction
--Project plan summary
--Project and mission objectives
--Related studies and activities
--Summary of technical plan
--Management approach
--Procurement strategy
--Project schedule
--Resources plan
--Management review
--Controlled items
A copy of this is to be found in Appendix C.

July, 1974

A no-cost extension of the contract was agreed to--extending the period of performance essentially to the end of September, 1974.

After attendance at the Denver T. U. Program Planning and Operation Conference, field interviews were held with:

- --Southwest Research Institute (Dr. Laenger)
- --Technology Application Center (Mr. Shinnick)
- --Western Research Application Center (Mr. Oulie *et al.*)
- --Stanford Research Institute (Dr. Anyos)
- --Stanford University School of Medicine (Dr. Harrison)
- --Stanford University (Mr. Reiner)
- --California Institute of Technology (Mr. Stam)
- --Knowledge Availability Systems Center (Mr. Howie *et al.*)

Wrap-up meetings with various public sector agency representatives in New England and with staff of NASA's Technology Applications Program and Office of Uses Affairs were also held.

Final discussions with representatives of the Denver Research Institute's TRIS project completed investigations into the feasibility of regional profiling.

August and September, 1974

Most of the time spent during these two months was concerned with final background readings, collating the results of field interviews and completing the final report.

RECOMMENDATIONS, OBSERVATIONS AND ACTION REQUIRED

The field survey interviews with TU program participants, NASA Headquarters TUO staff, Field Center TUO's RDC and Application Team Directors, DRI staff and public and private sector representatives provided insights from which the following recommendations are derived. These are based on four major premises:

- --Sufficient NASA TUO funds will be forthcoming and made available in the initial phases.
- --Other Federal and State funds will be forthcoming and made available in the medium and long term.
- --The host institutional constraints acting upon individual RAC's will be reduced to a minimum.
- --The RAC network is the primary interface for NASA with non-aerospace industry and will be used as such.

RECOMMENDATION ONE

It is feasible and desirable to add to the information dissemination functions of the NASA Regional Dissemination Centers a capability similar to that developed and used by the NASA Technology Application Teams thus forming Regional Application Centers.

Most RDC's are presently performing some aspects of an application function although the extent to which it is carried out is inhibited by the cost and the annual need to meet a budget part of which has to be covered by the sale of information services alone. In general there are information application groups rather than engineering application groups but the tendency is clearly apparent. A few examples will suffice. The original proposition for NCSTRC was that it should be primarily concerned with applications engineering which would be supplemented by information searching.[48/] ARAC emphasizes that it provides "answers instead of abstracts," and is currently involved in joint projects "to develop performance specifications and to carry out related testing and analysis work for technology utilized by local governments."[49/] TAC's diversity is even more marked, it being "organized into an information center operation and five major programs... The Industrial Program... The Energy Information Center, a joint effort with the School of Engineering... The Business and Industry Program... The Remote Sensing Program... and the Center for Environmental Research and Development." Of particular

importance is"...the growing demand from clients for evaluation and consultation beyond the level provided by the initial identification and citing of published information."50/ KASC, reporting to the University Provost through the Director of the University's Communications Programs is closely associated with these other programs and one of five university motifs for the next ten years is an interdisciplinary institutional effort in technology transfer. An applications engineering clinic in conjunction with the Engineering School is currently being proposed and various members of the faculty serve as engineering consultants to the KASC and its clients.51/ The comment quoted on page 17 that the provision of ways and means for formal center involvement through the RDC's would enhance the effectiveness of the RDC's service to clients is also supportive of this recommendation. The final justification is that if the RDC network can offer an applications capability it would considerably strengthen its ability to compete in the proliferating field of scientific and technical information services. Because of this proliferation, "...the competitive posture of RDC's has changed dramatically in the past decade simply in terms of the emergence of several dozen services providing alternative access to identical data bases...in some cases at no charge to industrial clients."52/ However, most of the competing services"...do not provide a technical specialist contact between end users and data bases."53/ Therefore to augment the RDC's technical specialist interface with access to the NASA data generators and in the limit to be able to ramify into laboratory investigation and prototype development work would strengthen the network's competitive edge immeasurably.

RECOMMENDATION TWO

It does not seem advantageous to associate present application teams organizationally with existing RDC's but it is clear that an RDC cannot have an effective application function unless that function is administratively and geographically integral with the RDC.

RECOMMENDATION THREE

The RDC's and NASA TUO HQ should list areas of potential applications activity additional to those currently existing and, on the basis of some rationale, form new application groups integral with each RDC.

There is unanimous agreement amongst RDC directors that in transforming RDC's into RAC's by adding to the dissemination function some kind of applications function, there would have to be administrative and geographic integrity. The merits of this point of view are self evident. However, existing application teams appear to be advantageously located from a number of points of view and there seems little justification for upsetting these arrangements. The fact that minimal use by the teams of the RDC information services has been made in the past and continues to decrease seems not to be considered reprehensible and, in any event, the shifting of the location of existing teams would not necessarily change this state of affairs without trauma. The existing teams have invested considerably

in establishing contact with Field Center personnel operating in the team's field of speciality as well as being familar to and having relatively personal relations with "opinion leaders" in that field of speciality. For example, one Bateam has been in personal contact with over 600 U.S. physicians in the last seven years and receives wholehearted support from all NASA Field Centers.[54/] Such relationships are invaluable and not to be upset without considerable justification. The staff of the teams view themselves as professionals in the field of technology transfer which is a more healthy view than one of merely being a NASA contractor doing the NASA's business.[55/] Such an outlook is clearly very supportive of the network concept and the achievement of the NASA TU mission objectives. Another point militating against relocation of existing teams is that the overall spectrum of RDC information search capabilities is very broad and has not permitted the development of an in-depth information speciality commensurate with Application Team needs. A further point to emphasize about team activities is the extent of industrial interest in team projects as a function of the definition and nature of the subject matter of the team's field of interest. It seems safe to assume that private industrial interest in subjects such as transportation and urban development is more extensive (and dollar worthy) than in the field of biomedical instrumentation. There is, then, the danger that team activities in such fields could compete with the information services offered on a fee basis to industry by the RDC's. A company with a problem in the field of, say, urban development, might prefer to seek NASA technology capable of solving its problem _via_ the team network rather than the

RDC network, particularly when the public interest is involved in the solution of that problem.

All these considerations lead to the conclusions that new and different subjects should be identified for the addition of applications functions to the RDC's. However, existing application teams should develop closer relationships with the RAC network so that:

--team problem solving capabilities are available to RAC industrial clients

--specific project results of team activities find an outlet via the RAC network

--in some cases the team operates as a divisional RAC office in addition to its regular function.

RECOMMENDATION FOUR

It is desirable that in formulating new areas of applications activity, that top-level representatives of the NASA Field Centers should participate in decisions on this subject.

It is obviously necessary to seek the participation of the NASA Field Center Directorate in the establishment of new application priorities for RAC's since the technical expertise to support the RAC exists at the Field Centers. Its continuing involvement and cooperation with the RAC's activities is mandatory for success. No further comment is necessary.

RECOMMENDATION FIVE

New applications groups formed should naturally have a strong technical basis in the chosen field of operation and the RAC thus created should be competent to deal with the business and industrial imperatives associated with the successful completion of specific projects.

References to successful commercialization as being the ultimate end point of technology transfer activities are many and the concept, at least, is commonplace. Since the proposed RAC network is NASA's primary interface with non-aerospace manufacturing industry, that network should seek to implement these commonplace concepts. A reasoned view has been expressed which seems to synthesize current thinking and is therefore included verbatim.[56/]

With the proliferating nature of 'technology transfer' activities within Federal Government Departments it is chauvinistically useful to view how NASA's T. U. program will continue to distinguish itself from others in (say) two years time. From any point of view, one must conclude that the nature of any unique visibility must involve, in a substantial manner, a real and perceivable commercial and industrial association with at least some of the completed and maturing projects, now the subject of development work and applications engineering. Although such projects are currently confined to the so-called Public Sector and the aim of the work being performed is to solve public sector problems, in the limit, the successful commercial exploitation of any discrete piece of NASA technology could contribute substantially to the unique visibility that the T. U. program merits.

With this end in view, it is clear that:

1) An 'active' rather than a 'passive' program to involve suppliers and users is necessary.
2) Such a program should be optimally 'active' and not piece-meal, arbitrary and capricious.
3) Since control (in the public interest) of end point supply and utilization (ie. commercial exploitation)

can only effectively be maintained on the basis of the limited monopoly conferred by the issuance of a patent, patentability and ownership of the patent are considerations of first importance.

4) Control in the public interest is important in view of the increasing concern for 'technology assessment', namely, evaluation before the fact of all the second order effects of the introduction of new technology. Control for commercial reasons is equally important.

5) Even if patent considerations are not agreed to be universally paramount, there are a number of other considerations of equivalent importance. This leads to the conclusion that criteria should be established, agreed to and applied to the evaluation of candidates for development and applications engineering or indeed, any NASA technology available and suitable for commercial exploitation. Tentative suggestions of criteria for candidate selection have already been made elsewhere.

6) On the contentious point of what exactly is a 'public sector' problem, it seems perfectly valid to advance the argument that three such problems currently are:

   (a) Unemployment
   (b) Balance of Payments
   (c) Inadequate Tax Revenues

   The successful and substantial commercial adoption of NASA technology, whatever the subject, can therefore be demonstrated to be contributory to the solution of these three problems. Ancillary considerations such as the economic upgrading of industrially depressed communities, the need to support and sustain small business and minority business might affect decisions in specific cases but are, however, subsumed by the generalities referred to above.

7) It does not necessarily follow, because a group of people have conceived a piece of new technology (eg. a NASA Field Center or a NASA contractor) or have been concerned with demonstrating its feasibility in the solution of a problem (eg. an Application Team or a NASA Field Center), that the same group is suitable or competent to implement a program to secure its optimal use and commercialization; indeed, it has been demonstrated that the converse is more likely to be the case, namely that the inventing or developing team should be divorced from the commercialization function except in a technical advisory capacity as and when needed.

8) It can be shown that one element contributing to the success of new technology commercialization is the

early and meaningful involvement of a company or companies with the particular project. In many respects it is an unsound tactic to go it alone to the end of feasibility demonstration and then arbitrarily present the results to potential users and suppliers on a 'take-it-or-leave-it' basis. Early involvement promotes a sense of commitment; meaningful involvement needs financial commitment. This can be achieved by joint, rather than unilateral funding of development work and application engineering wherein the company contribution is evidence of earnestness and good faith and the federal (NASA) contribution has a shared-risk, pump priming motive. Whenever a project is commercially successful (ie. profitable for the industrial partner) there should be a levy (preferably a patent license royalty) on sales at least up to a point where the federal (NASA) development expenditure has been recouped together with a reasonable return on the federal (NASA) investment.

9) The separation which seems to exist between the 'commercialization' activities of the TUO and the Office of the Patent Counsel in terms of the disposition of NASA patent rights by licensing needs to be closed by a means more effective than mere attendance at meetings of the Inventions and Contributions Board. Indeed it is questionable whether the deliberations and decisions of any Board could usefully be responsive to the real imperatives of optimal commercialization except in a 'rubber-stamp' mode.

10) It may be self evident but it certainly requires emphasis that adherence to a defined time schedule of progress in the evaluation of development candidates, the performance of development work and the initiation and implementation of commercialization is extremely important so as not to lose momentum and motive and, let it be said, opportunity.

11) Equally self-evident is the need for authenticated documentation and other design, construction or formulation information on the basis of which replication of hardware can be successfully accomplished.

12) The provision of quantitative information about market potential is contentious; perhaps the optimum mode of proceeding is the often referred to principle of 'minimum effort (and expenditure) to demonstrate non-viability'. This is to say that, above a certain amount of activity nothing should be done until further progress (towards commercialization) is unequivocally blocked. At such a point, a decision would then be made about the merit of indulging in additional expenditure to remove the blockage. The absence of quantitative market information

might frequently be such a block; equally, however, there may be a significant number of cases where qualitative market information, when combined with all other factors, might suffice for a 'go-ahead' decision. It should be added that some kind of market information or at the lowest level a market view or judgement, is necessary at the candidate selection phase.

13) Considerations involving overseas exploitation should not be divorced from similar domestic considerations. In fact, they exist concomitantly and should be dealt with similarly. A total strategy needs to be formulated for each case.

14) It may be contended that an 'active' policy in this respect is likely to be expensive and the first order returns not support proper cost/benefit desiderata. Work sponsored by NASA at the University of Maryland in the middle sixties does not support such a contention.

RECOMMENDATION SIX

The RAC's should create positions for technical liaison with the Field Centers and the occupants of these positions should spend a substantial part of their time on location at Field Centers and should endeavor to serve the RAC network as a whole.

RECOMMENDATION SEVEN

Field Center personnel should be seconded for duty with RAC's for periods of time not less than six months.

The purpose of these two complementary recommendations is necessary and obvious. An increasing intercalation between Field Centers and RAC's is needed and a reciprocal interchange of personnel is the best way of achieving this. Field Center personnel would benefit from an increased understanding and experience of RAC operations and missions as well as the difficulties and pitfalls of working in a commercial mode in the industrial area. Exposure to RAC clients and potential clients would help enormously to increase a Field Center awareness of the context, constraints, dilemmas, and imperatives of those potential clients. Conversely, the importance associated with the need of the RAC network to become familar with Field Center personnel and expertise cannot be over-emphasised and it has been observed many times that face-to-face contact is most efficacious in accomplishing this.

RECOMMENDATION EIGHT

It should not be necessary to limit new areas of applications activity to areas of broad public sector interest, and it is desirable to develop applications expertise pertinent and inherently attractive to the private sector.

This recommendation is based on a difference of perception concerning so-called public sector problems and problems, the solution of which, would be in the public interest. The term 'public sector problems' is used at a very high level of generality and usually confers an aura of respectability on the investment of effort and funds in attempts to provide specific solutions. 'Massive sociological problems' subsumes transportation, law enforcement, environmental protection, education, housing and urban development in one reference.[57/] There is, curiously enough, no mention in this list, of health and health care. A listing of state areas of interest representing potential project opportunities gives air pollution, water resources, water quality, mental health, transportation and public lands management.[58/] Another includes agriculture, forestry and recreation, energy and mineral resources, economic development, marine resources, public administration and welfare.[59/] It is tempting to consider that a public sector problem is one the solution of which does not attract the interest of private industry for various reasons mostly associated with uncertain profitability. The most frequent observation on this subject is that the

public sector market can only be served by private industry when that market is 'aggregated'. Another way of looking at it is to understand that specificity is the bench mark of successful technology transfer and that the successful solution of public sector problems is only achieved when the specificities are meticulously attended to. For example, one NASA technology application team is concerned with public sector problems in Urban Development. One of the successful specificities arising from the program is a flat electrical conductor cable. It would be difficult to envisage in vacuo that a flat electrical conductor cable could contribute significantly to the solution of a public sector problem and it is only when put into the general context of reducing urban construction costs does its significance emerge. However the cable does have ramifications of commercial importance in almost any form of building construction and is therefore an inherently attractive commercial proposition thus increasing the transfer potential of that particular piece of NASA technology. It is suggested that a diversification into other areas in which the public interest would be served by technology transfer problem solving would be salutory. Examples of such areas could be corrosion, fatigue and wear; machinery design for minimizing power reguirements; management practices for small businesses; alternative materials, etc. There must surely be others.

RECOMMENDATION NINE

A Regional Application Center Coordinating Office and Committee should be established.

The office should function in an advisory capacity to NASA HQ TUO, as a service to the RAC network and should operate on behalf of the network as a whole. The committee should give high level direction to, and establish new priorities for, the network. Its membership should comprise a chairman from NASA TUO, the Executive Director of the Coordinating Office and representatives of RAC top management and / or RAC host institutions and NASA Field Centers. Conceivably prominent people from the federal and state governments and industry could be co-opted to serve on an intermittent basis.

The need of the RDC's for a central secretariat was recognized as early as 1967 with the founding and incorporation of the Action Council of Regional Dissemination Directors (ACORDD). It was originally envisaged that ACORDD might be funded by the NASA TUO for purposes associated with network service development and new initiatives but this never occurred. ACORDD was primarily a loose association of RDC Directors with a part-time secretariat and conceptually was to meet and function independently of NASA TUO. However, it never achieved the autonomy of action and decision it

was originally intended to have and for several reasons is now moribund. However, the need remains and the establishment of a Regional Application Center network will intensify this need. The network as a network cannot develop solely on the basis of individual, unilateral initiatives intermittently taken by its individual modes or by NASA TUO HQ. A RAC Coordinating Office, concerned with all network functions, investigating developments of value to the network and assuring the active participation and mutual support of all RAC's and Field Centers, is mandatory. It should also serve in an advisory capacity to the RAC Coordinating Committee and NASA HQ TUO by issuing periodic position papers on subjects of relevance to network operations and expansion for formal decision by the Committee. It could also produce or contract for the production of a network news letter and be actively involved with network supporting activities of NASA TU HQ referred to in Recommendation Ten below. Finally, because of its central coordinating function, it is possible to envisage the office acquiring the right to take assignment of patent rights from NASA and the network, becoming the beneficial owner of associated 'know-how' and design rights, being associated with the negotiation of agreements for disposal of this industrial property on behalf of the network and, in some cases to enter into agreements itself. "The formation of a viable network and central secretariat...would relieve the burden on a government department (NASA TUO and Code GP) of operating in a semi-commercial mode by assigning these functions

to a captive but relatively unfettered organization which would, at the same time, operate to optimize progress towards the goals of NASA TUO and Code GP."[60] In this way, RAC's will have a greater role with respect to the NASA patent licensing program and also the 'Applications Advocacy Plan' of NASA's Office of Applications. So far as the patent licensing program is concerned this could be effected by assignment of NASA patent rights to elements of the RAC network via the RAC Coordinating Office for purposes of active commercial exploitation in the public interest. Equally, the right to inventions made during the course of any RAC's activities, could by prior agreement, vest in either particular RAC's or the Coordinating Office for beneficial disposal by licensing, assignment, etc.

RECOMMENDATION TEN

A variety of supporting activities-most requiring the expenditure of TU Headquarters top management man-hours and travel funds will be needed throughout the Program to broaden awareness of TU Program importance, both to NASA and to the user communities the program seeks to serve. Specific examples are:

---NASA Field Center Top Management---a continuing cyclical series of briefings and discussions with Field Center Directors and their senior management and technical staffs to emphasize the importance of their participation in the applications network, the specific ways in which they can assist and the returns to the Field Center as a result. High emphasis should be placed on Field Center involvement in developing new ways to improve RAC network interaction.

---RAC Network---active promotion of awareness of and support for the individual RAC's and the network as a whole should be maintained at various levels.

---Congressional committees concerned with such national aspects as economic and commercial development, health, housing, energy, transportation environment, safety, etc., and specific members of Congress whose districts and states are served by RAC activities. An active and continuous but low-

level effort will substantially aid the Program, not only in the area of budget support but also by obtaining the assistance of individual Senators and Representatives, their offices and staffs in creating broad awareness and use by public and private organizations "back home." A "newsletter" approach, describing regional, state and local NASA sponsored applications projects and RAC activities in a specific way and aimed at providing selected members of Congress with a quarterly, if not monthly, flow of "news items" could be a cost-effective way to gain valuable support.

---Other Federal agencies should be informed on a regular basis of RAC and applications project activities relating to their areas of interest and responsibility and to the regions containing their principal demonstrations or technical efforts (eg EPA-Raleigh, Cincinnati; DOT-Cambridge, Pueblo, Colorado; NAFAC-Atlantic City)

---Regional, State and local governments should be apprised of the total TU Program scope, the RAC Network and the specific RAC Serving them. A current awareness approach implemented again through a brief monthly or quarterly newsletter providing primary and secondary points of contact could be broadly distributed to and through the ten Federal Regional Councils or appropriate

Federal Offices, or to selected regional, state and local agencies or projects.

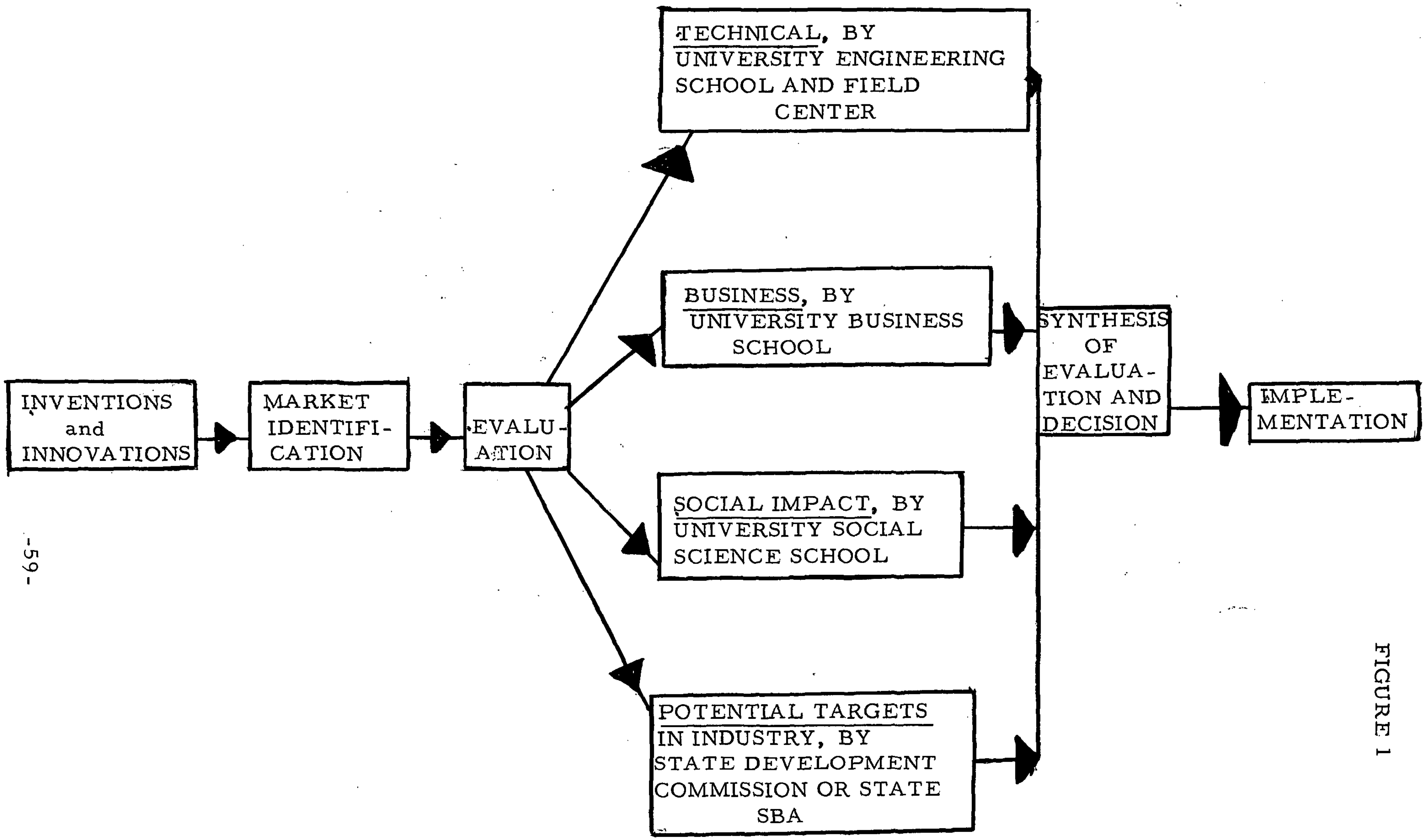
---Industrial firms--large and small--should be reached through a national "advertising" effort by TU Headquarters in cooperation with the Department of Commerce (including SBA). In addition, and as has already been proposed, seminars for high level representatives of potential RDC industrial clients are needed as are specialists for small business operating out of the RAC's and their divisional offices.

RECOMMENDATION ELEVEN

RAC's must play an active role in seeking and realizing greater regional and national exposure and utilization of Field Center technology and technological skills.

Specific projects based on Field Center-developed technology could be systematically identified and evaluated for further development and commercial exploitation by an RAC, possibly on a joint venture basis with particular elements of the private or public sector. An experimental project with one RAC and one Field Center is recommended to explore this possibility along the lines initiated in Figure 1.

FIGURE 1



OUTLINE OF EXPERIMENTAL METHODOLOGY FOR FIELD CENTER - RAC JOINT VENTURES

RECOMMENDATION TWELVE

Because of the intended transfer of RAC contract responsibility to NASA Field Centers, the Field Centers must fully understand that their role will be critical to the successful operation of the RAC network.

Some of the important needs will be to:

- --contrive meaningful top level center contact for RAC management
- --develop a Center/Regional rationale for selecting the information and application specialities of the RAC
- --provide adequate details of discrete Center developments for the RAC network with appropriate access to Center personnel and contractors
- --recognize the importance of the business imperatives of the RAC's context of operation
- --support the RAC network concept which must involve other centers and RAC's and which is necessary to preserve present non-NASA funds and current efforts to increase these
- --avoid operational control which would make networking difficult; permit the RAC to have substantially day-to-day operational autonomy
- --relate the current and proposed regional activities contained in the 'Applications Advocacy Plan' of the NASA Applications Office to RAC activities
- --recognize that the RAC's ability to integrate information and application to secure utilization will have economic and social implications of operational research and teaching interest to the host institution
- --anticipate the possibility of difficulties with the host institution due to the unusual nature of the RAC mission and indifferent cooperation at the administrative support level
- --appreciate, in the long-term, that the RAC network may need to tap federal agencies other than NASA for significant and applicable technology

RECOMMENDATION THIRTEEN

Network and Field Center communication modes do not appear to be state of the art nor optimally effective and it is recommended that computer conferencing be investigated as an improved alternative.

Computer conferencing is based on the use of a computer for throughput thus "establishing links between individuals, between an individual and a group, or between groups." 61/ It is therefore a person-to-person interactive process rather than the person-to-machine process which has been the primary aim in the development of the field of computer networking and time-sharing. The individuals or groups linked "...may interact at the same time or, more typically, at their convenience with the computer holding all messages until accessed." 62/

Systems of computer conferencing are in use or being developed by civilian agencies of the federal government, the University of Illinois, the Institute for the Future in California, Northwestern University, Scientific Time Sharing Corporation, Maryland, Bell Northern Research, Canada, the Augmented Knowledge Workshop at Stanford Research Institute and the Newark College of Engineering, New Jersey. 63/

The relevance of computer conferencing techniques to the operation of an effective network of RAC's, Field Centers, Federal, State, local and private industrial centers of resources and needs requires no emphasis, and their use might constitute the single most important

feature in achieving the technology using the problem solving goals of a national technolgy transfer effort. This is particularly the case with RAC's and Field Centers since the current 'Problem Statement' technique is not usable by RDC's at present due to time, money or manpower problems nor can NASA Field Center TUO's, by themselves, presently cope with any increase in the number of problem statement submissions communicated and disseminated by conventional methods. All the elements for improvement seem present. Computer conferencing:

> "--Offers an easier and more flexible way to access and exchange human experience;
>
> --Increases (virtually to infinity) the size of the common "information space" that can be shared by communicants (and provides a wider range of strategies for communicants to interrupt and augment each others' contributions);
>
> --Raises the probability of discovering and developing latent consensus. (The enriched information base and heightened interconnectedness increases the chances that each conferee can receive unexpected and/or interesting messages)."[64/]

An analysis of costs and benefits of computer conferencing both financial and otherwise seem favorable.[65/] One highly important fact relates to the enhanced quality of the interchange. One user comments on

computer conferencing as follows:

"It has a flavor which is quite unlike any other form of communication, for example, face-to-face exchange. For instance, you have whatever time is needed after receiving a message to get your own thoughts together and come back with a fairly incisive and coherent reply. You don't have the effect of thinking up snappy comebacks ten seconds too late. On the other hand, the messages go back and forth so rapidly, perhaps several times a day between any two particular participants--that it is completely unlike first-class mail, which is so slow that you really lose the interactive characteristic. It is unlike the telephone in a couple of important ways, too. I can communicate with someone at a time of my choosing, not wait for him to answer the phone or get filtered through his secretary. Nor is he interrupted by the message in what he is doing..."[66/]

RECOMMENDATION FOURTEEN

Steps should be taken to provide additional information services which RDC's consider would contribute to client problem-solving.

Although application teams do not consider they need additional information services since they are wholly oriented towards the application of NASA technology, some RDC's do. The present information resources used by RDC's comprise, in the main, R. and D. report literature and journal articles on specific subjects. This generally means that successful RDC solicitation of clients is largely confined to industrial companies having an overt R. and D. function. To make solicitation of and service to clients more effective, particularly small businesses and straight manufacturing and marketing companies, it would be useful to have sources of information, reasonably accessible in the business and management fields (of the type found in Factory Managers Magazine); in process technology (although Engineering Index does have some); and in manufacturing management. Equally useful would be access to NASA contractors for 'real-life' contractor manufacturing information and software such as in-house 'how-to' manuals, 'cook-books' and process and procedures handbooks. The establishment of improved communications and routine channels to access special sources of information is also needed. Some examples of frustration in this respect are the non-

availability of manufacturing specifications of specific items of equipment purchased by NASA, e.g. heat pipes; contractor developed manufacturing techniques, e.g. for printed circuits; information which is known to exist but is just not available e.g. in the remote sensing field. Part of the solution to these problems rests, of course, in improved total network communication modes.

RECOMMENDATION FIFTEEN

It is considered that the best way of determining the need for RAC services by Federal Regional Offices would be through the Federal Region Council. It is recommended that in the first instance an experimental information service be provided to one Federal Regional Council by one selected RAC.

Federal Regional Councils were established in February, 1972 "to coordinate federal grant making operations and to improve working relations between the Federal agencies and state and local governments."[67/] Membership of the Councils consists of the principal regional officials (there are ten Federal Regions) of the major federal departments together with ad hoc participation by others. The councils are located in Boston, New York, Philadelphia, Atlanta, Chicago, Kansas City, Denver, Dallas, San Francisco and Seattle. Amongst several objectives of the Southwest Federal Regional Council in its program for Region VI is the development of a regional profile of "information about regional needs" in order to meet the Council's objective of "improving delivery of Federal services to state and local governments..."[68/] This being the case and on the assumption that other Regional Councils will have similar objectives it seems that the most viable method for RAC's to secure an entree to the Federal Regional Offices is by way of these Councils to which presentations of the work and objectives of the RAC's could

conveniently be made. Naturally the need for a problem solving service and the effectiveness in supplying it will be a function of the role and mission of particular offices and it is impossible at the moment to forecast the extent of their need for problem solving assistance. It is however, possible to hypothesize a need for information services. For example in Region VI, HUD 701 planning money is generally distributed through the Regional HUD Administrator in Dallas to the Council of the State Governments for that region. Use of these funds by the states for, say, land use planning might motivate the Regional HUD Administrator to want to monitor information in the remote sensing field. Similarly, Regional funding for housing development programs could stimulate a need for information services in a number of areas. One problem could exist with Regional SBA Administrators who might want to avail themselves of a technical information service for onward transmission, free, to regional small business, in competition with the fee based service normally offered by the RAC.

These and other ramifications could best be explored on an experimental basis by making formal arrangements between one RAC and the Federal Regional Council in its area to determine and then service the perceived information needs of a selection of the members of that Regional Council.

RECOMMENDATION SIXTEEN

A systematic but simple regional profiling method should be developed jointly by the present RDC Application Team groups and NASA T. U. HQ to be used in making the RAC network's resources known to public sector organizations at regional, state and local levels.

During the course of this study a number of interviews were conducted with state, regional and local agency directors and staff members to identify points of contact for RAC in assessing and serving public sector needs. Extensive discussions were subsequently held with the Denver Research Institute TRIS Project Director and staff members to develop an approach to public sector profiling. It was determined that:

(1) the principal problem faced by the public sector at the present time is a budgetary one, and therefore,

(2) the introduction of technology will be based upon its cost-saving potential in the near term, and finally,

(3) technology, if it is to be introduced must be supplied through traditional channels--namely, existing, largely private sector, distribution channels--or

(4) through use by regulatory agencies in the regulation and control process, of

devices or systems provided by the private sector.

Thus, the public sector profiling technique must take into account the ultimate user and the supplier.

State agencies corresponding to the specific applications area--e.g. transportation, health and medicine, environmental pollution--should be apprised of the information services available and the Applications Engineering projects underway or completed. However, since the principal influence regarding change (and specifically the introduction of technology) is the Federal government (through grants on the one hand and regulations on the other), the most effective means by which the Technology Utilization Program can assist in state, local and regional technology applications is through cooperative arrangements with such agencies as EPA, HUD, HEW, FEO at the highest levels (first) and Regional office levels (second). It will therefore be necessary for NASA T.U. HQ to arrange for a regional technology information and applications assistance to state, regional and local jurisdictions through the 'good offices of the Federal Regions, especially in broadcasting the availability of RAC services through regional newsletters and announcements. These Regional Offices should also be used, through prior agreement at Headquarters levels, to arrange for Applications Engineering project demonstrations (jointly sponsored) and specific problem-solving assistance to local-level agencies on a case-by-case basis.

RECOMMENDATION SEVENTEEN

A separate and specific effort to seek out and identify regional/local public sector problems per se should not be included initially in the RAC network spectrum of activities. Major program efforts aimed at obtaining, cataloging, correlating, and circulating problem statements should be avoided in favor of the approach outlined in RECOMMENDATION SIXTEEN, above.

An effort to survey systematically, public sector agencies and organizations will result in the waste of valuable and limited RAC resources. To do this would need a massive effort to identify problems instead of selling services; correlating and cataloging detailed needs and intercommunicating via the network for purposes of achieving consensus regarding importance; searching for applicable technology and obtaining assistance from Field Center technologists. While it is important to identify opportunities for technology applications, the spectrum of problems at operating levels in the public sector is as broad as to defy cost, effective, timely selection let alone solution. Since some problem identification is vital in the transfer of technology to the public sector, the existing examples of transfer--Applications Engineering projects and independent Field Center efforts--should be effectively utilized as catalysts in the problem identification process, providing a basis for ad hoc exploration with state

and local agencies. These transfer examples should be described in mini-report forms which can be distributed directly to non-Federal public agencies and incorporated in Federal Regional Office newsletters through a continuing arrangement established by NASA T.U. Headquarters and the appropriate Agency headquarters. They should be used both as products to sell and advertising catalysts in the problem identification process.

It is suggested that brief but informative brochures be prepared on each of several projects relevant to state and municipal government needs to serve to introduce the effectiveness and usefulness of the RAC technology transfer network.

RECOMMENDATION EIGHTEEN

Mutually compatible, analytical techniques should be developed and utilized by RAC's for determining the regional profiles of potential customers in the private sector.

Certain RDC's presently use techniques for before-the-fact identification of firms whose technological orientation(i.e. products, manufacturing processes, or marketable services) matches the specific data bases of the RDC. As the functions of and services provided by the RAC's expand--dissemination of Tech Briefs, TSP's, SP's, Application Engineering reports, hardware demonstrations and technology applications assistance--a much broadend market spectrum will emerge. Adequate information exists, usually within state government offices and regional agencies and commissions concerned with economic and industrial development, to classify according to size, location, products manufactured, processes employed and diversifications or sales growth potential those firms constituting high-probability opportunities for; (1) information services; (2) specific applications engineering project participation or commercialization or (3) technology application assistance. Specific, near-term action suggested is the combining of all available profiling methods and data used by RDC's to form a network directory for use by each RAC, Field Center and NASA T.U. Headquarters in coordinated marketing activities.

RECOMMENDATION NINETEEN

NASA T.U. HQ should enter into formal arrangements with national associations and societies to make RAC network activities and capabilities known in both the private and public sectors.

A large number of professional, technical trade and industrial organizations exist in the United States, each serving a basic communication and cross-fertilization role within the various disciplines represented. For instance, the IEEE has 160,000 members, and the American Chemical Society 110,000 members in their technical, professional ranks. The American Society of Traffic and Transportation has 2,100 constituents involved in transportation problems, and the Association for the Advancement of Medical Instrumentation has 3,000 members involved in this highly specialized, technical field. The Electronic Industries Association has more than 250 member companies, while the Council of Defense and Space Industries Association lists some 1,700 firms. All major associations and societies publish monthly newsletters or magazines and many sponsor conferences, symposia and exhibits. Many are structured along regional lines, with local chapters reflecting regional interest and activities. Such regional orientations suggest significant potential gain through RAC participation at local levels, coordinated and sponsored through joint collaborative efforts between NASA and the national society or association headquarters. Specific action suggested is the

negotiation by NASA T.U. Headquarters of a cooperative information dissemination program to acquaint the membership of three national organizations---one professional-technical (e.g. IEEE, ASME, AAMI), one industrial trade (e.g. EIA, NEMA, CDSIA) and one public sector professional/technical (e.g. Transportation Association of America, American Society of Traffic and Transportation, American Hospital Association)--with the RAC Network generally, and specific capabilities in;

--Applications Engineering projects

--technical information services

--technology application assistance

Initial effort should focus on creating awareness generally--advertising and promotion--and on specific on-going examples of T.U. RAC network projects and services. NASA HQ participation in one annual meeting held by each organization should also be arranged.

RECOMMENDATION TWENTY

Consideration should be given and a decision made about the RAC's primary function and <u>raison d'etre</u>.

In adding an applications function to the current mode of operation of the RDC's, there is ambiguity about how this applications function is to be deployed since current Tateams are wholly supported by NASA TUO in the interests of transferring technology. On the other hand, RDC's are encouraged to make progress toward self support on the basis of client fees for services rendered, and this implies that RAC's applications services should be partially funded, at least, from client fees. The adoption of one or the other of these alternatives will profoundly affect any RAC's view of its opportunity costs, its targets, cost/benefit analyses, and its potential return on investment.

Upon the extent to which a RAC provides increasingly diversified services in its region will depend on the amount of both 'front end' and 'back end' funding required.

'Front end' support will be needed, among other things, for:

--marketing efforts in the private sector for clients, unlikely, <u>prima facie</u>, to become clients--particular small business
--general public relations efforts for the TU Program
--marketing the problem solving concept to the public sector
--determining whether information exists in the 'quick-fix' situations
--operating in the present application team mode

--funding for agency arrangements for purveying the RAC services in remote parts of the region (this point is partically met by the recent proposals to form RAC divisional offices)

'Backend' support will be needed, among other things, for:

--making completed applications projects operational
--optimizing effort at transferring applications projects
--covering incidental costs of packaging a specific solution to obtain its application on a national scale by the network

RECOMMENDATION TWENTY ONE

NASA TU Headquarters, with the consent and assistance of other Federal agencies, should conduct a series of briefings in the ten Federal Regions.

These briefings would seek to:

- --acquaint the various regional offices with the RAC network
- --describe in detail on-going or completed projects relating to public sector needs
- --invite them to make use of the local/regional RAC serving their area
- --enlist their aid in promoting the use of the network by state and local agencies and industrial concerns in the region
- --identify major problems and specific opportunities for the application of technology, especially those with potential for joint funding by Federal or state agencies.

The ten Federal Regions comprise a national network, largely for the distribution of Federal funds and the evaluation of the effectiveness of their use by state and local agencies. In performing the latter function, they constitute a significant problem identification system, establishing priorities for the expenditure of federal funds and goals for state and local agencies to strive for, and attempting to achieve greater efficiency and impact through joint efforts by the various states within the Region. They are for the most part staffed with non-technical, administrative personnel, with technical expertise found only in regulatory offices or Federal laboratories within the Region.

The most urgent task for RAC's is one of advertising and promotion--

the first step toward technology transfer must be to create awareness of both a general, broad capability and specific examples of the application of that capability. During the course of this study little or no general knowledge of NASA's technology transfer programs at the regional and state levels has been detected. The visible examples of technology transfer are few, though there are many applications engineering projects that relate to needs common to all ten Regions.

The New Federalism places great emphasis on regionalization and revenue sharing. Greater authority and increased resources are being placed at Regional levels and joint Federal-state activities are increasing significantly. The RAC approach is consistent with regionalization and can be highly supportive of Federal actions to assist regional, state and local agencies, if a consistent top-level effort is undertaken by NASA Headquarters to establish awareness and agreement concerning the RAC support role. The series of briefings for the Federal Regional Councils in all ten Federal Regions should be supplemented by a similar series of briefings for the offices of the Secretaries of HUD, DOT, HEW, DOI, DOC and the offices of the Administrators of EPA, and FEO. The RAC Network and its services should be presented and specific Applications Engineering projects described. The objective of such briefings should be to establish a basis for mutual support--informal RAC advertising and promotion activities by the Regional offices and technology support by the RAC network.

RECOMMENDATION TWENTY TWO

It is recommended that an effort be undertaken immediately to provide SIC designations for Tech Briefs, SP's, compilations, Applications Engineering projects for technology-matching purposes at RAC's. It is further recommended that a simple catalog of Field Center technology and expertise be prepared--similarly coded along SIC lines--for use by RAC's in identifying sources of assistance available through the Field Center TU offices.

The sheer volume of technology documentation and diversity of technical capability within the NASA suggests that an accessing means compatible with the widely acceptable SIC identification system be adopted to speed up the technology-problem/need matching process. Many Tech Briefs describe technology applicable to a variety of products and processes but rapid, cost effective identification is not possible. Applications Engineering projects are more definitive in terms of applications but the users, agencies and manufacturers, are not specifically noted. If RAC's are to effectively and economically advertise and market their information and applications services, a system allowing rapid individual access to potentially useful technologies or helpful technologists is paramount.

It is suggested that TU Headquarters initiate effort to identify, by SIC Code the technology and Field Center capability within the TU Program scope and provide a catalog as a basic, initial tool for public and private sector marketing and technology assistance purposes.

RECOMMENDATION TWENTY THREE

RAC targets and objectives should be considered as threefold, namely, the needs of the region, the organizations of the region, and projects from the region in both the private and public sectors.

The private and public sector needs of the region involve:

- --the use of information as information
- --problem solving motivated by a need for a short term 'fix' not involving formal literature searching or applications effort
- --problem solving in the context of a desire for improvement on the basis of medium term solutions from bodies of information and physical application of this information

The private and public organizations of the region will demand service as information users, pure and simple, and in a problem solving mode both short and medium term. In addition, services to respond to organizations' (usually private) wish to diversify will also be important.

Regional projects will need service in the sense that it is necessary to promote their adoption both regionally and nationally either by the regional RAC on a national basis or by networking. In many cases there are no such things as regional problems and a successful regional project will many times have national applicability.

RECOMMENDATION TWENTY FOUR

If it is desired it seems feasible for NASA to progressively reduce its funding of the total RAC program from a maximum of 80% in the first operational year to 7% at the end of the fifth operational year.

Reasonable estimates for achieving this objective are to be found in Table 1 and Figure 2. The figures given relate to the support of one Regional Application Center. The breakdown of RAC funding requirements is based a RAC organizational structure shown in Figures 3 through 8, and is:

--Salaries and Wages (S.&W.)		
Director	$ 30,000	
5 Associate Directors	$ 100,000	
12 Application, Information and Marketing Specialists	$ 192,000	
Secretarial Functions	$ 50,000	
Faculty and Students	$ 20,000	
		$392,000
--Overhead @ 50% of S.&.W.	$ 196,000	
--Communications and Travel	$ 50,000	
--Services	$ 50,000	
--Contingencies	$ 62,000	
TOTAL		$750,000

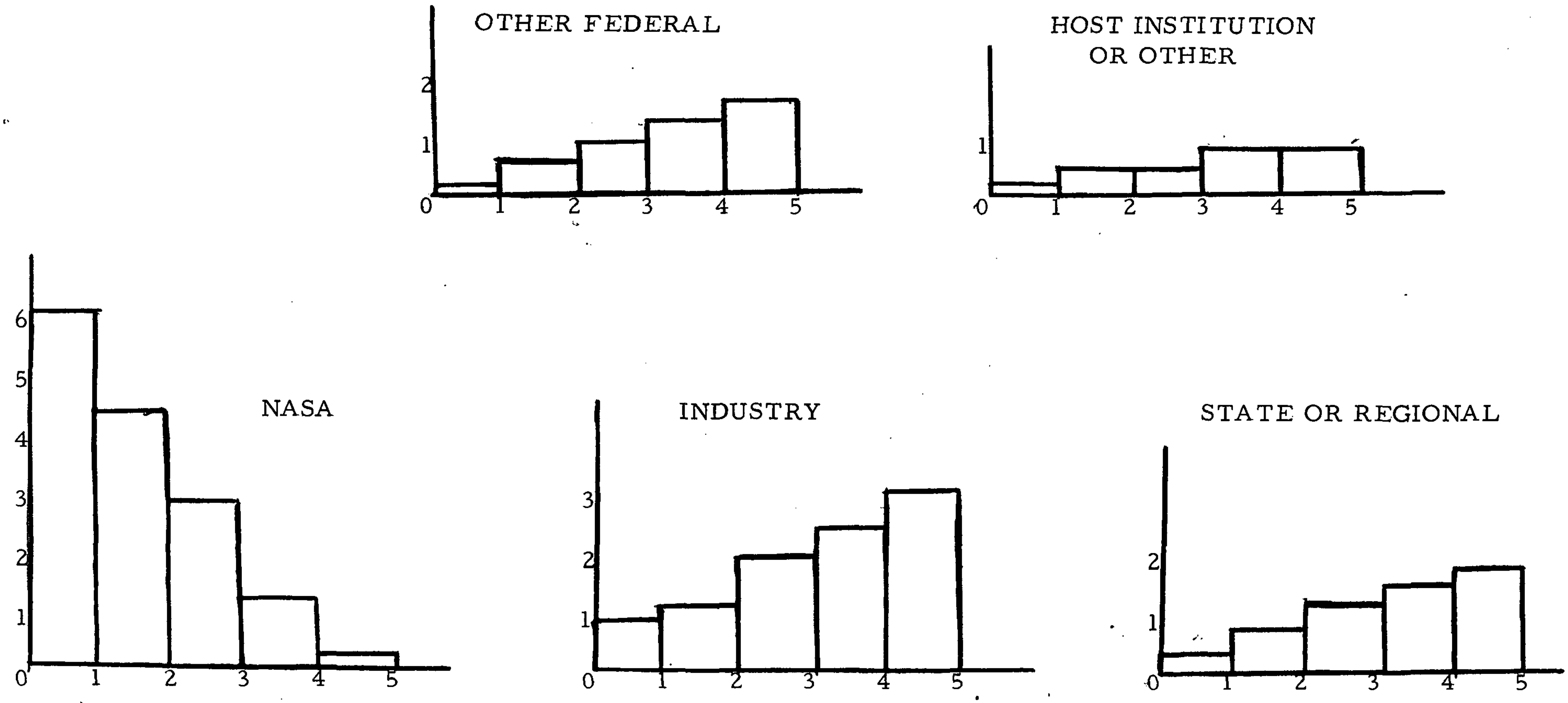
The first year NASA funding required (80% of the total) is substantially the same percentage of the total funding of the RDC's and Application Teams as in CY 1973 (which was 78%). The actual average funding for CY 1973 for one RDC and one Application Team was $500,000. NASA funds to one RDC (including the performance bonus) was $215,000 and average RDC client income, was $110,000. Average application team funds amounted to $175,000. Therefore, the NASA contribution was $390,000 or 78% of the total cost. Of course the total funds required the first year of the envisaged Regional Application Center network are much larger since the total effort will be considerably increased. For a network of six RAC's a minimum expenditure of $3,600,000, exclusive of current Application Team funding and the cost of the proposed RAC divisional offices, is needed in the first year. Private sector support exists, will increase and is tangible but federal, state and local support is needed, and has been minimal to date. Considerable political lobbying is vital to the success of the program.

TABLE 1

NASA TUO FUNDS	OTHER FUNDS					TOTAL	RATIO TUO FUNDS / OTHER FUNDS
AVERAGE FOR CY 73 $390,000 (78%)	$110,000 22%					$500,000	3.5:1
	OTHER FEDERAL FUNDS	INDUSTRIAL INCOME	STATE OR REGIONAL SUPPORT	HOST INSTITUTION OR OTHER SUPPORT	TOTAL NON-NASA FUNDS		
END YEAR 1 $600,000 (80%)	$15,000 (2%)	$90,000 (12%)	$30,000 (4%)	$15,000 (2%)	$150,000 (20%)	$750,000	4:1
END YEAR 2 $450,000 (60%)	$75,000 (10%)	$112,500 (15%)	$75,000 (10%)	$37,500 (5%)	$300,000 (40%)	$750,000	1.5:1
END YEAR 3 $300,000 (40%)	$112,500 (15%)	$187,500 (25%)	$112,500 (15%)	$37,500 (5%)	$450,000 (60%)	$750,000	0.66:1
END YEAR 4 $150,000 (20%)	$150,000 (20%)	$225,000 (30%)	$150,000 (20%)	$75,000 (10%)	$600,000 (80%)	$750,000	0.25:1
END YEAR 5 $50,000 (7%)	$187,500 (25%)	$250,000 (33%)	$187,500 (25%)	$75,000 (10%)	$700,000 (93%)	$750,000	0.07:1

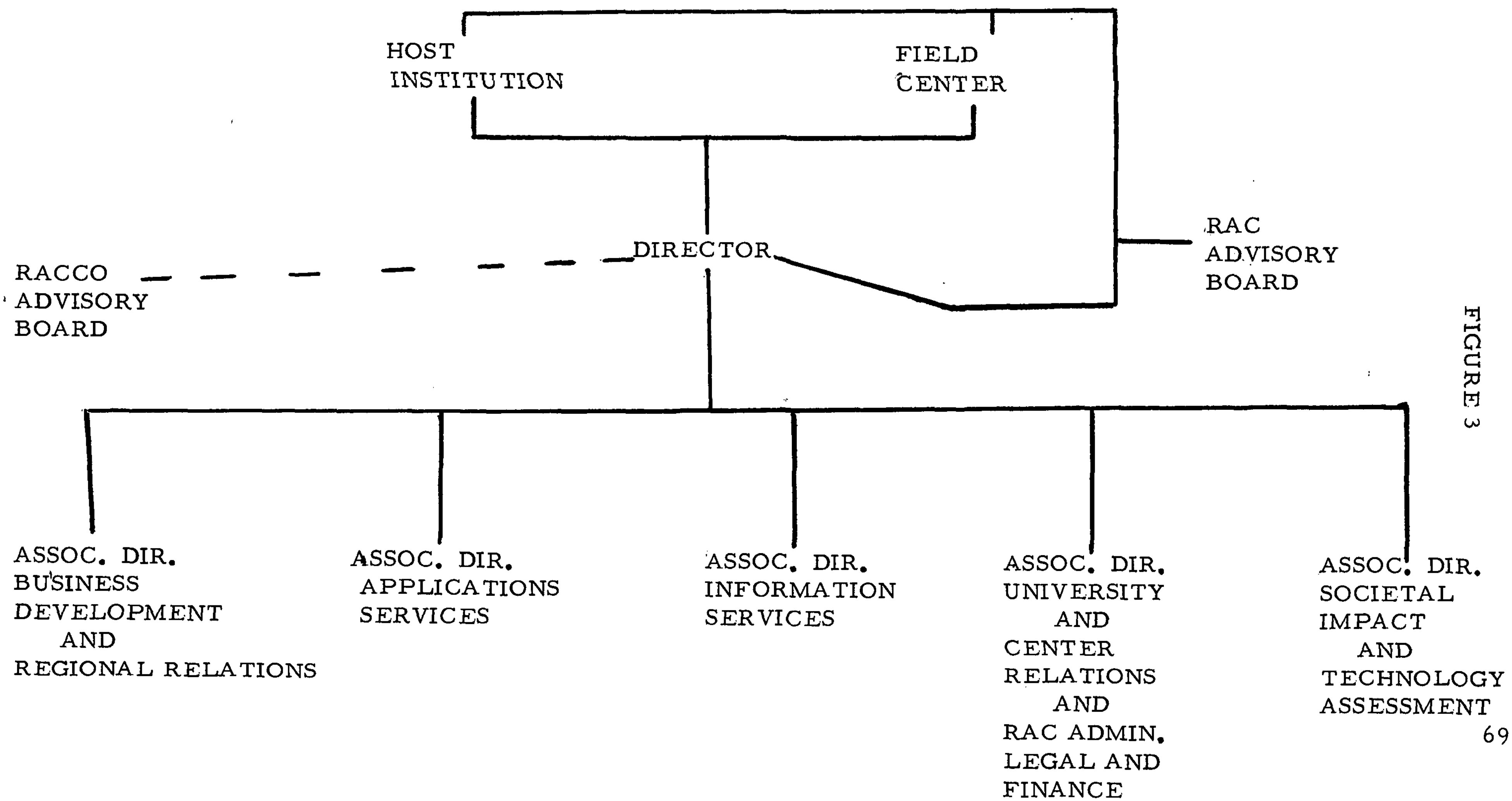
PROGRESSIVE REDUCTION IN NASA FUNDING SUPPORT FOR PROPOSED RAC NETWORK

FIGURE 2



PROJECTED CHANGES IN RAC FUNDING SUPPORT OVER THE FIRST FIVE YEARS IN $ X10^{5}

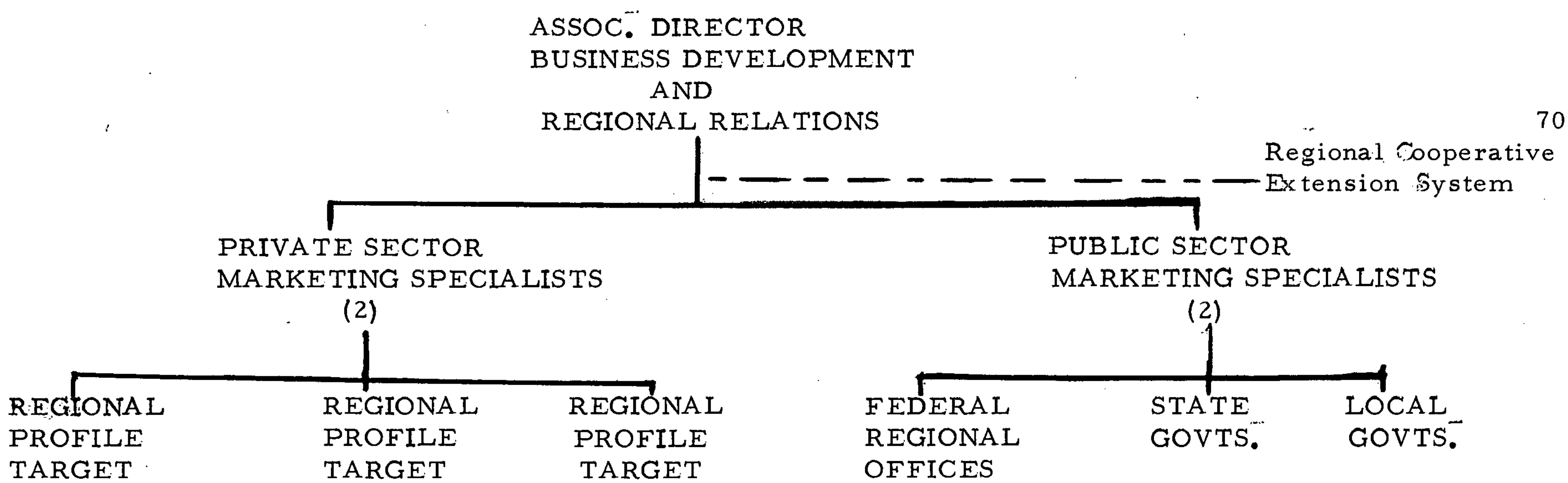
FIGURE 3



69/

A PROPOSED RAC ORGANIZATIONAL STRUCTURE

FIGURE 4



A PROPOSED STRUCTURE FOR RAC BUSINESS DEVELOPMENT AND REGIONAL RELATIONS

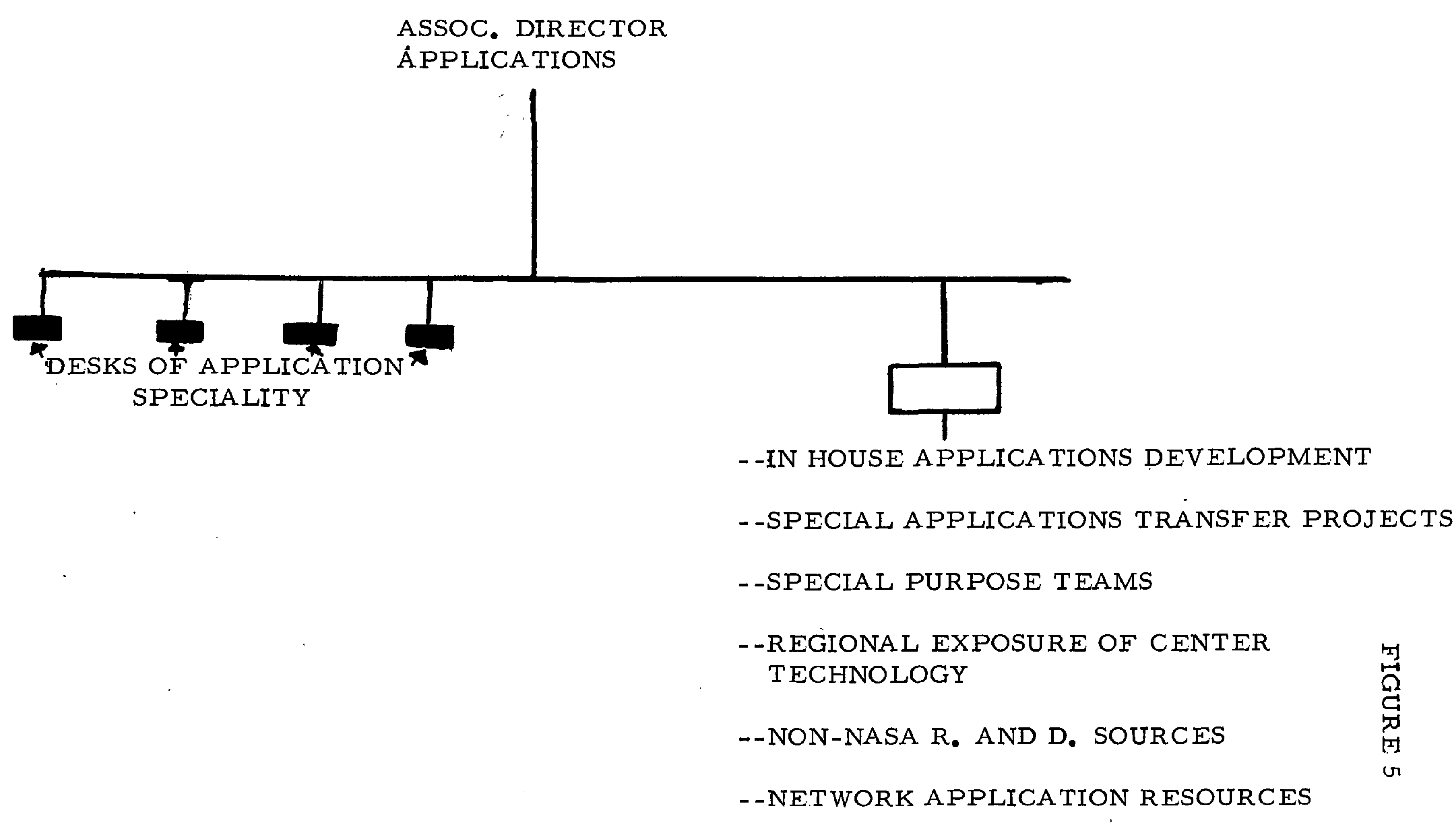


FIGURE 5

A PROPOSED STRUCTURE FOR RAC APPLICATIONS FUNCTIONS

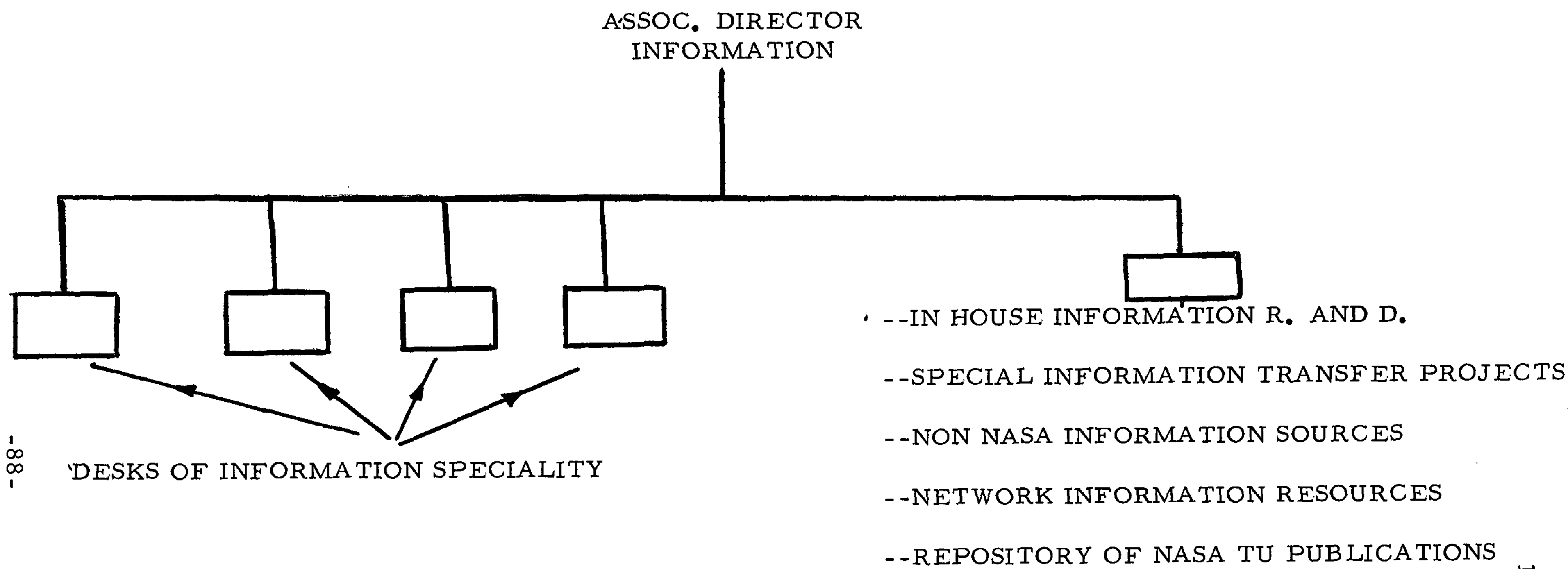
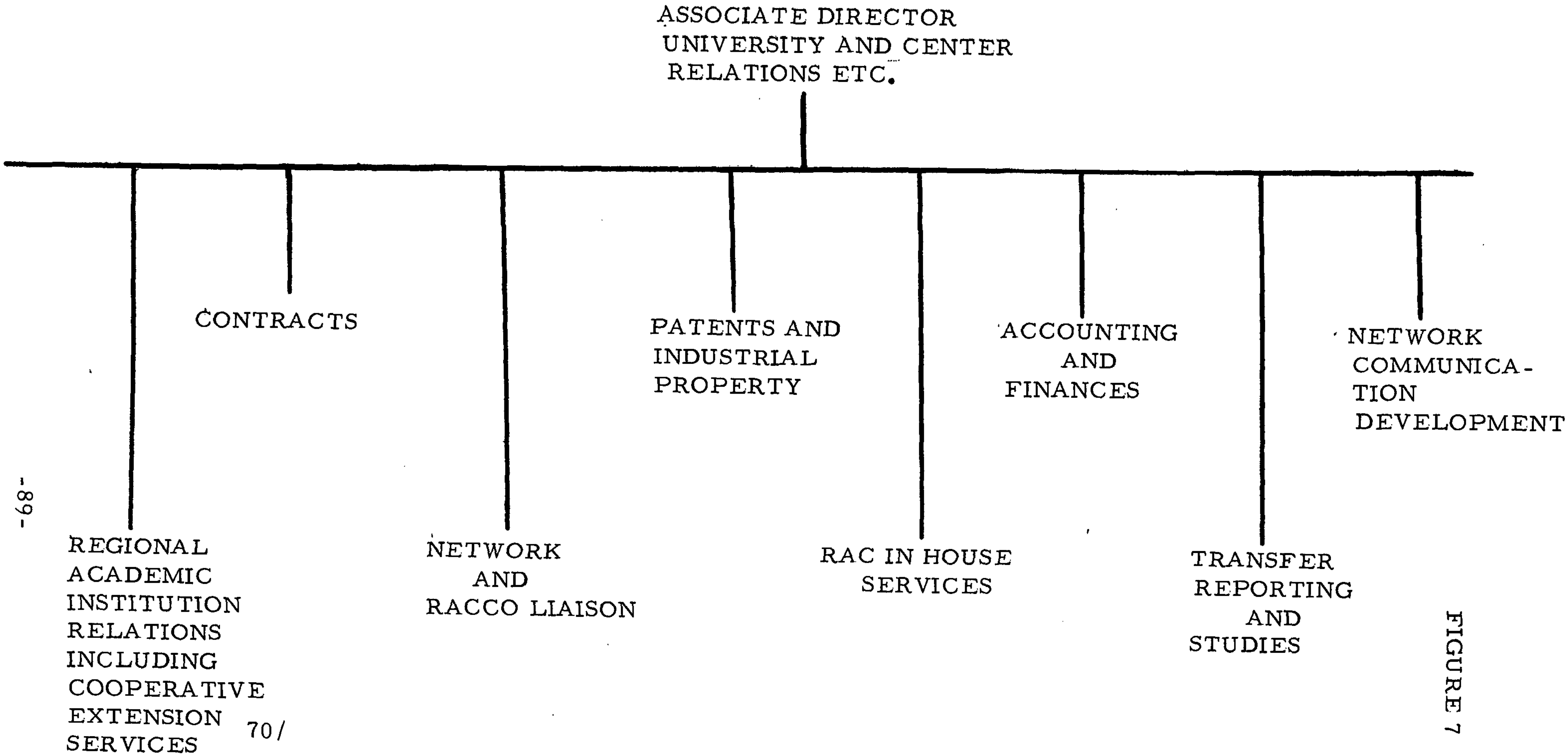


FIGURE 6

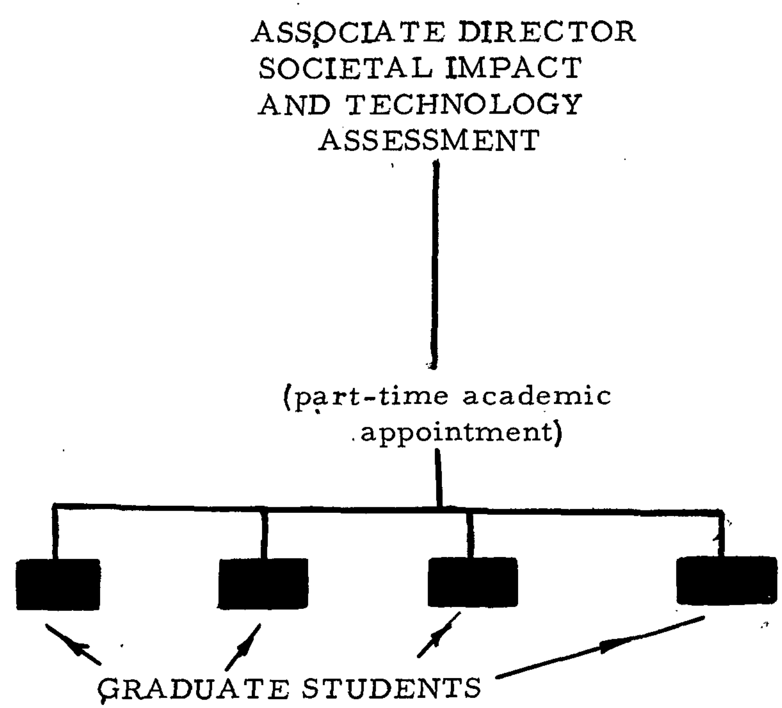
A PROPOSED STRUCTURE FOR RAC INFORMATION FUNCTIONS

FIGURE 7



A PROPOSED STRUCTURE FOR RAC ADMINISTRATIVE AND LIAISON FUNCTIONS

FIGURE 8



A PROPOSED STRUCTURE FOR RAC SOCIETAL IMPACT AND TECHNOLOGY ASSESSMENT NEEDS[69/]

LONG RANGE GOALS

Each RAC must become a regional node of a national interactive technology application network which sustains and develops expertise in:

- --information retrieval and dissemination
- --communications networking
- --interpretive and hardware application and development
- --local, state and regional problem solving
- --beneficial disposal of any industrial property both domestically and overseas
- --teaching and studies in technology transfer and technology assessment
- --cultivating pioneering-type inventions by manipulating an environment which will stimulate the creative output of inventors likely to make pioneering inventions
- --obtaining political and funding support from Federal, Regional, State and local authorities as well as the provision of paid for services and the acquisition of financial benefits accruing as a result of the successful commercialization of projects and patents.

Such a network could, in five to ten years,time, become the responsibility of a new Federal agency jointly sponsored by both technology-using and technology-producing entities. Ultimately, the creation of a problem data

bank to coexist with a solution data bank should enable existing technology both public and private to be optimally matched with existing needs, both public and private, in a context where the public and a private sector interface is one characterized by open communication, respect, mutual trust and a determination to serve the public good and foster national well being.

FOOTNOTES

1) Victor, C. Ferkiss, Technological Man: The Myth and the Reality, Published by George Braziller, Inc., New Yrok, 1969, p. 40

2) George Bloxam, Licensing Rights in Technology, Published by Gower Press Ltd., London, England, 1972, p. 3

3) Victor C. Ferkiss, Op. cit., p. 42

4) Ibid, p. 43

5) Ibid, p. 44

6) Ibid, p. 44

7) C.H.G. Oldham et. al., Trends and Problems in World Trade and Development, a study prepared for a United Nations Conference on Trade and Development, New Delhi, India, 1968, p. 15

8) Ibid, p. 17

9) Ibid, p. 18

10) George C. Nichols et. al., Technology Enhancement Programs in Five Foreign Countries, U. S. Department of Commerce, Washington D.C., Report No. COM-72-11412, 1972, p.1

11) Ibid, p. 5

12) Ibid, p. 5

13) Ibid, p. 4

14) Ibid, p. 1

15) Comptroller General of the United States, Means for Increasing the Use of Defense Technology for Urgent Public Problems, Report No. B-175132, U.S. General Accounting Office, Washington, D.C., December, 1972, p. 38

16) National Academy of Engineering, Technology Transfer and Utilization, Washington, D.C., 1974, p. 16

17) John Geise, The Role of the Regional Dissemination Centers in NASA's Technology Utilization Program, NASA Contractor Report CR-1763, May 1971. Part II pages 9-29 gives an excellent account of the development of the Technology Utilization Program, as a whole.

18) PL 85-568, National Aeronautics and Space Act of 1958: 29 July 1958, sections 203 (a), 102 (c) (4) and 102 (c) (8) and as subsequently amended

19) NASA Contract NASr-162

20) Wall Street Journal, March 20, 1963. This article did report the host institution as regarding the initial meeting with potential ARAC industrial clients as a "chance to shoot craps for $5,000." This was a reference to the ARAC membership fee.

21) Indiana Alumni Magazine, February, 1963, p. 7

22) Ibid, p. 9. Adam Smith was quoted with approbation; "It is not from the benevolence of the butcher, the brewer or the baker that we expect our dinner but from their regard to their own interest." Exactly whether anyone was to be benevolent and who was supposed to be having regard to their own interest was left ambiguous.

23) John Geise, op. cit., p. 18

24) In 'KASC Luncheon/Semminar,' July 10, 1974. (A brochure produced for a marketing luncheon semminar by the Knowledge Availability Systems Center, University of Pittsburgh.)

25) William A. Shinnick, Director, TAC, in a private communication, April, 1974

26) Philip Wright Associates, 'A Project to Enlarge and Intensify the Transfer to and Utilization of NASA Technology in the Industrial and the State and Local Government Sectors of the United States', prepared for the Office of Technology Utilization, June, 1974, p. 1

27) In 'Regional Dissemination Center Program Review' presented during a Technology Utilization Program Planning and Operations Conference held at the Denver Research Institute, Denver, Colorado, July, 1974

28) Peter J. Chenery, Director, NCSTRC in a letter to NASA HQ TUO, November, 1973

29) George Washington University, Applications of Aerospace Technology in the Public Sector, final report for NASA Contract NASw-2055, The Biological Sciences Communication Project, Washington, D.C., May 1971, p. 42. (Much of this account of the genesis of the Application Teams derives from this report, pages 41-56)

30) Carl von E. Bickert and James E. Freeman, An Examination of the NASA Biomedical Application Team Program, NASA Contract No. NSR-06-004-063, Denver Research Institute, Denver, Colorado, May, 1969, p. IV

31) Ibid, pages 5-6

32) Research Triangle Institute, NASA Biomedical Application Team Program, semi-annual report, September, 1969-March, 1970, Research Triangle Park, North Carolina, pages 3-4

33) Ibid, pages 6-7

34) Ibid, p. 60

35) David F. Culclasure and Linda Eckhardt, Southwest Research Institute, Assistance to NASA Biomedical Areas of the Technology Utilization Program, Final Report, August, 1972, NASA Contract No. NASw-1867, San Antonio, Texas, p. 83

36) Tom Anyos et. al., Technology Transfer-Transportation, Annual report under NASA Contract NASw-2455, Stanford Research Institute, Menlo Park, California, August, 1973, p. 3

37) Ibid, p. 1

38) ABT Associates, Preliminary Information from 1973 Final Report, Cambridge, Massachusetts, November, 1973, p. 46

39) Carl von E. Bickert et. al., op. cit., pages 5-6

40) Research Triangle Institute, op. cit., p. 3

41) Ibid, p. 36

42) Ibid, p. 58

43) Research Triangle Institute, Application of Aerospace Technology in Biology and Medicine, semi-annual report, September, 1972-February, 1973, Research Triangle Park, North Carolina, p. 55

44) David F. Culclasure and Linda Eckhardt, op. cit., p. 83

45) Joseph G. Berke, Activities of the NASA Sponsored SRI Technology Application Team in Transfering Aerospace Technology to the Public Sector, Annual Report, July 1, 1970-June 30, 1971, NASA Contract No. NASw-1992, Stanford Research Institute, Menlo Park, California, p. 5

46) ABT Associates, Inc., Urban Development Application Project, Final Documentation, July, 1970, Cambridge, Massachusetts, pages 31-32

47) W. L. Smith, 'Program Planning and Operation Conference, Technology Application Division' presented at a NASA T.U. Conference hosted by the Denver Research Institute, Denver, Colorado, July, 1974

48) Peter J. Chenery, Director, NCSTRC, during field survey interview, April, 1974

49) Robert D. Shriner, Director, ARAC, in a letter to NASA HQ TUO, March, 1974

50) William A. Shinnick, Briefing of the TAC Organization, presented to the T.U. Program Planning and Operations Conference, Denver, Colorado, July, 1974

51) Edmond Howie, Associate Director, KASC, during field survey interviews, January, 1974

52) James E. Freeman, The Competitive Posture of NASA Regional Dissemination Centers, Industrial Economics Division, Denver Research Institute, Denver, Colorado, July, 1974, p. 1

53) Ibid, p. 9

54) F. T. Wooten, Director RTI Bateam during field survey interviews, February, 1974

55) Tom Anyos, Director, SRI Tateam during field survey interviews, July, 1974

56) The George Washington University, Final Report of the Technology Applications Group, Department of Medical and Public Affairs, Science Communication Division, Washington, D. C., NASA Contract NASW-2444, August, 1973, Appendix F, pages 146-151

57) Comptroller General of the United States, op. cit., p. 1

58) The State of Texas, Science and Technology Progress Report, December, 1972-June, 1973, Office of the Governor, Division of Planning Coordination, Austin, Texas, Appendix A

59) Gulf South Research Institute and Mississippi Research and Development Center, A Study of Federal Resources, Mechanisms and Barriers Regarding Technical Assistance to the States of Louisiana and Mississippi, prepared for the National Science Foundation, Project No. NSF-CA118, Baton Rouge, Louisiana and Jackson, Mississippi, April, 1974, Appendix D, pages D1-D7

60) The George Washington University, op. cit., p. 15

61) Charlton R. Price, Conferencing via Computer, Innovation Information and Analysis Project, The George Washington University, Washington, D.C., April, 1974, p. 5. This report is an excellent state-of-the-art survey of the subject.

62) Ibid, p. 3

63) Ibid, pages 6-12

64) Gordon, Thompson, Moloch or Aquarius, THE No. 4, Bell Northern Research of Canada, February, 1970, in Charlton R. Price op. cit., pages 5-6

65) Charlton R. Price, op. cit., pages 12-17

66) Lawrence A. Breed, Scientific Time Sharing Corp., Palo Alto, California, private communication in Charlton R. Price, op. cit., p. 22

67) Southwest Federal Regional Council, Leadership for Better Government, Dallas Texas, 1973, p. 1

68) Ibid, p. 6

69) Vary T. Coates, The Process of Technology Assessment in the Federal Government, Summary Report, Program of Policy Studies in Science and Technology, The George Washington University, Washington, D.C., July, 1972. On page 10 it is stated that "... secondary benefits and costs (of the NASA Space R. and D. program) have not been thoroughly assessed from the standpoint of determining the appropriate position of space programs in national priorities." In view of this comment it seems advisable to encourage a technology assessment function within each RAC.

70) J.O. Grantham, Project Report on Utilizing Extension Service in Land-Grant Universities as a Technology Transfer System for Environmental Affairs, NSF Grant # GT-39426, Oklahoma State

University, Stillwater, Oklahoma, January, 1974. This report is concerned with an investigation of how Land Grant University Cooperative Extension Services could be used effectively in technology transfer in the environmental field. The conclusions of the report are favorable and definite---". . . the Cooperative Extension Service can facilitate the transfer of much of the technical environmental information needed by local government officials and other community leaders and do it as least as effectively and probably more economically than any alternate system." It seems advisable therefore that a RAC should have at least an informal linkage with Cooperative Extension Services in its region of operation.

BIBLIOGRAPHY

There are several excellent and comprehensive bibliographies relating to the general subject of technology transfer and utilization, federal participation, information, etc., etc., so that it seems gratuitous and redundant to generate another one. The reader is therefore referred to the following reports for both their bibliographies and their substantive content responsive to the generalities and specifics of this present study. References already used and noted in the footnotes (page93) are not repeated here.

Chakrabarti, A.K. and Rubenstein, A.M., The Effects of Techno-Economic and Organizational Factors on the Adoption of NASA Innovations by Commercial Firms in the U.S., 1972 Northwestern University, Evanston, Illinois

DeSimone, Daniel V., Technological Innovation: Its Environment and Management, January, 1967, U.S. Department of Commerce, Washington, D.C.

Enzer, Selwyn, Federal/State Science Policy and Connecticut, October 1971, Institute for the Future, Middletown, Connecticut

Little, Arthur D., Fostering Industrial Growth in Massachusetts, October 1970, Cambridge, Massachusetts

National Security Industrial Association, Special Survey of Industrial Experience in the Application of Advanced Technology to Civil Sector Needs, February, 1972, Washington, D.C.

National Governors' Conference, Policy Positions, 1973-1974, Office of Federal-State Relations, Washington, D.C.

Palmer, Archie M., Administration and Utilization of Government-Owned Patent Property, NASA Contract NASw-177, December, 1960 National Aeronautics and Space Administration, Washington, D.C.

Robbins, Martin D. et. al., Federal Incentives for Innovation, NSF Contract No. C 790, November, 1973, Denver Research Institute, Denver, Colorado

Roberts, Robert E. and Gadberry, Howard, Study of a Contractor's Capabilities Center and the Technology Transfer Process, September, 1968, NASA Contract NASr-63 (09), Midwest Research Institute, Kansas City, Missouri

Rosenbloom, Richard S. and Wolek, Francis W., Technology and Information Transfer, 1970, Graduate School of Business Administration, Harvard University, Boston, Massachusetts

Rubinstein, Ellis, Societal Aspects of Technology, January, 1974, IEEE Spectrum

APPENDIX A

NASA TUO POSITION PAPERS

JANUARY, 1974

NASA TUO Position Paper: RDC Marketing

Current position:

Some progress in CY 1973 over CY 1972 is evident. Over-all sales have increased by about 24%. Nevertheless, the RDC sales program needs to be intensified to satisfy increasing Congressional demands for adequate cost recovery and increasing the number of transfer opportunities.

New initiatives proposed:

Neal Ruzic, under contract to NASA TUO, will be approaching each RDC director to determine how Ruzic can supplement individual RDC marketing programs in over-all market development, market research, sales training and brochure design.

Action items for RDC directors:

Supply information on proposed percentage of funds to be allocated for marketing in CY 1974 (10 day response time).

NASA TUO Position Paper: RDC Incentives

Current position:

The increase in RDC network income in CY 1973 testifies to the efficacy of some kind of incentive scheme and a modified incentive program will continue in CY 1974.

New initiatives proposed:

(a) In CY 1974 incentive payments will be on a graduated scale and will increase in proportion as earned income exceeds the base-line incentive goal. Thus, the greater the amount earned beyond the base-line figure, the higher the incentive payments will be.

(b) These payments will be shared between the RDC operation itself and as an incentive bonus to individual staff members.

Action items for RDC directors:

Supply information on the basis for allocation of bonus payments between the RDC operation itself and individual staff members (10 day response time).

NASA TUO Position Paper: RDC Marketing Territories

Current position:

The primary marketing territories of the RDC's are defined and established. Active marketing by each RDC is confined to its territory except where a client wishes the RDC to service affiliate and subsidiary companies in other territories. If this happens, the director of the RDC whose primary territory is affected will be notified appropriately. All other extra-territorial leads will be referred to the relevant RDC directors.

New initiatives proposed:

Ambiguity about territory in and around Philadelphia will be resolved.

Action items for RDC directors:

(a) Decide how to handle products such as satellite photographs, SIP's, etc. which can have substantial extra-territorial demand.

(b) Indoctrinate staff about the current marketing territory limitations and *modus operandi*.

NASA TUO Position Paper: RDC Client Follow-up

Current position:

Client follow-up techniques vary considerably among the RDC's; the provision of information about transfers is arbitrary and capricious. Follow-up is also necessary to ensure client satisfaction with the service or to rectify inadequate service.

New initiatives proposed:

RDC directors must establish a formal, consistent and continuing follow-up program to ensure customer satisfaction and to secure information on transfers (always recognizing the need for maintaining commercial confidentiality about proprietary information). An RDC staff member should be given a definite responsibility to make a transfer report to NASA TUO on a monthly basis. Such reports should contain actual 'transfers' and those showing future potential. If, in any month, there are no reportable transfers, a negative report must be made. In addition, a cumulative list of transfers with full details must be provided on or before 15 December of any year, for that calendar year. The primary use of this cumulative calendar year report will be in testimony before Congress.

NASA TUO Position Papers: New RDC Product Lines

Current position:

There is no established policy for the introduction of new product lines either by the RDC network or by individual RDC's.

New initiatives proposed:

A discussion and a determination by RDC directors of the need for and feasibility of the introduction of new RDC and network product lines.

Action items for RDC Directors:

(a) Provide NASA TUO with a complete list of network data bases, their mode of use, their location. Include information about manual searching.

(b) Make a concerted decision about using the NTIS as a network outlet for special RDC products.

(c) Make a network decision about RDC's becoming patent licensing agents for NASA.

NASA TUO Position Papers: New RDC Services

Current position:

The primary goal of current RDC services is industry; the primary service is technical information.

New initiatives proposed:

RDC's should develop closer relationships with state and local governments to encourage them to jointly fund with NASA, projects of utility to them. RDC's should also be prepared, in this context, to become increasingly involved in the implementation and application of technology by local and state governments.

Action items for RDC Directors:

Report steps proposed to implement the new initiatives above and the systematic reporting to NASA TUO of opportunities for applications engineering work for state and local governments.

NASA TUO Position Paper: The RDC Network

Current position:

Despite some doubts and hesitancy by individual RDC's about the merit and efficacy of the RDC network concept, NASA H. Q. at the highest levels, is actively emphasising the concept when responding to inquiries for information about RDC's. These leads amount to as many as one hundred per month; the new RDC network brochure is widely used for this purpose.

New initiatives proposed:

An intensification of the implementation of networking by bona-fide efforts at lead referral and mutual use of data bases and other individual RDC products and services.

Action items for RDC Directors:

Review previous experience with networking and report problem areas to NASA TUO for action and solution. One example of a problem area is difficulty with the Chemical Abstracts and Engineering Index services.

NASA TUO Position Paper: RDC Service Prices

Current position:

Separate decisions in each RDC are made about prices and pricing policy and there is no apparent consistency or identity in the results of these decisions.

New initiatives proposed:

A review and critical analysis of all RDC service charges.

Action items for RDC Directors:

Supply price lists for all services offered, justify them and show the allocation of costs to these prices.

NASA TUO Position Paper: Communications and Program Management Reporting Requirements

Current position:

Reports are required by the NASA Contracts division as specified in all RDC contracts (Form 533 reports, quarterly progress reports and final reports). NASA TUO also requires additional reports in its program management capacity (monthly, quarterly and an annual cumulative report).

New initiatives proposed:

Systematize the monthly, quarterly and annual reports for NASA TUO program management as follows:

(a) Monthly program management report

This report, which can be in letter form, will contain transfer information from the follow-up program. Negative reports should also be made as well as accounts of emerging transfers which will continue to be monitored and reported on until they mature. These reports will also form the basis for the annual cumulative transfer report due 15 December for the current calendar year.

(b) Quarterly program management reports

Items to be included are:

--Earned income for the period

--Number of clients using more than $50 in services including annual clients

--Number of clients using less than $50 in services

--Number of documents sold, including satellite photographs

--A breakdown for each salesman of visits and sales calls during the period and the number of new clients or renewals obtained

--The percentage of the total operating budget allocated to marketing during the period

--Any significant new or planned marketing campaigns

--Problem areas, e.g., network services, host institution problems; client relationship problems; any problems with any services to the RDC, etc. Problems requiring NASA attention and action should be so designated. It should be noted that within 30 days after the receipt by NASA TUO of all RDC quarterly

program management reports, NASA TUO will provide each RDC director with a summary of network performance during that quarter, with client income, names of clients, problems posed and solved and any new actions and initiatives taken or contemplated by NASA TUO.

(c) Annual (CY) program management reports

Items to be included for the previous and current calendar year are:

--Total number of organizations served

--Income generated (in $1,000)

First quarter

Second quarter

Third quarter

Fourth quarter

Total

--Breakdown of users

Industrial

Other commercial

Governmental

Medical

University

Other

--Breakdown of industrial/commercial users by size

Large (500 employees or more)

Small (500 employees or less)

In addition, a list of the names of the calendar year clients, in alphabetical order is required and must be in two sections, one containing clients using more than $50 in services and the other using less than $50 in services. Each section will have three headings; Searches, Documents and Photographs. If a client buys a search and subsequently some documents, its name will appear under both headings.

Action items for RDC Directors:

Discuss, comment on and implement these program management reporting requirements.

APPENDIX B

INTERVIEWS CONDUCTED

INTERVIEWS CONDUCTED

PUBLIC SECTOR AGENCIES

New England Regional Commission, Boston, Mass.
George Sahady, Dan Dowd

New England Municipal Center, Durham, N.H.
Henry Bourgeois, Intergovernmental Coordinator

New England Center for Industrial Resource Development, Durham, N.H.
Owen Durgin, Director

State of Vermont, Montpelier, Vt.
Bernard Johnson, Director of Planning

Commonwealth of Massachusetts, Boston, Mass. --Department of Commerce and Development
David Turner, Science and Technology Director
Roger Jewitt, Director, Commercial and Industrial Development Bureau

Department of Natural Resources
Matthew Connolly, Director of Planning

State of Connecticut, Hartford, Conn.
James Musanti, Director, Locational Services Division

Connecticut Product Development Corporation
K. E. V. Willis, Director

Town of Narragansett, Rhode Island
Robert Killoran, Town Manager

New England Bureau for Criminal Justice Services, Boston, Mass.
Robert Hamilton, President
Dennis Crowley, Vice President

U.S. Department of Transportation, Washington, D.C.
Jay Christensen, NASA-DOT liason office

National Research Development Corp., London, England
Basil J.A. Bard, Managing Director
H.J. Crawley, Chief Executive, Department of Engineering

PRIVATE COMPANIES

Hotwatt, Inc., Danvers, Mass.
Robert Lee, President

Charleswater Associates, Boston, Mass.
William Plouffe, President

Technology Consulting Group, Inc., Boston, Mass.
Michael Brose, President

Chemetron Corporation, Chicago, Ill.
Patrick Cunningham, Vice President
James Stearns, Assistant Director R&D

G. D. Searle, Inc., Skokie, Illinois
Dr. Gloria Cohen, Director, Scientific and Technical Information

Innovatis, Wilmington, Delaware
Dr. Ernest J. Breton

ACADEMIC INSTITUTIONS AND RESEARCH INSTITUTES

University of Massachusetts, Boston, Mass.
Peter Kaplan, Special Assistant to the President

Massachusetts Institute of Technology, Cambridge, Mass., MIT Development Foundation, Inc.
Nelson Upthegrove, Project Manager
David Coit, Assistant Project Manager
John Flender, Treasurer

University of Maine, Portland, Me., Center for Research and Advanced Study
Halsey Smith, Director

University of Maine, Orono, Me.
Charles Tarr, Project New Enterprise

Denver Research Institute, Denver, Colo., Industrial Economics Division
Conrad Heins, Director, TRIS Project
William Hildred, Douglas Johnson, James Freeman
Senior Staff Members

The George Washington University, Washington, D. C., Innovation Information and Analysis Project Program of Policy Studies in Science and Technology
Wesley Tennant, Project Manager

California Institute of Technology, Pasadena, California
Lee Stam, Patent Officer

Stanford Research Institute, Palo Alto, California
Neils Reimer, Manager, Technology Licensing

REGIONAL DISSEMINATION CENTERS

Aerospace Research Application Center (ARAC), Indiana University, Bloomington, Indiana
Robert D. Shriner, Director, and colleagues

Knowledge Availability Systems Center (KASC), University of Pittsburg, Pittsburg, Pennsylvania
Edmond Howie, Director, and colleagues
Allen Kent, Director Communication Program
Elizabeth Duncan, Director, Campus-based Information System

North Carolina Science and Technology Research Center (NCSTRC), Research Triangle Park, North Carolina
Peter J. Chenery, Director and colleagues

Technology Application Center (TAC), University of New Mexico, Albuquerque, New Mexico
William A. Shinnick, Director, and colleagues

Western Research Application Center (WESRAC), University of Southern California, Los Angeles, California
A. Kendal Oulie, Director, and colleagues

TECHNOLOGY APPLICATION TEAMS

Abt Associates, Cambridge, Massachusetts
David J. MacFadyen, Manager

Research Triangle Institute, Research Triangle Park, North Carolina
F. T. Wooten, Director

Stanford Research Institute, Palo Alto, California
Tom Anyos, Director

Stanford University School Of Medicine, Palo Alto, California
Donald C. Harrison

Southwest Research Institute, San Antonio, Texas
Charles Laenger, Director, and colleagues

NASA FIELD CENTER TECHNOLOGY UTILIZATION OFFICERS

Several were interviewed informally as opportunity and occasion presented themselves.

APPENDIX C

A PROJECT PLAN TO:

Enlarge and intensify the utilization of NASA technology in the industrial and the state and local government sectors of the United States

Introduction

Starting in 1963, the National Aeronautics & Space Administration Headquarters Technology Utilization Office (NASA HQ TUO) has built a network of six Regional Dissemination Centers (RDC's), largely university based. Their primary purpose has been to secure non-aerospace industrial utilization of NASA derived technology by the provision of technical information services of various kinds to industrial--and in some cases, other--clients. The effort has been funded by NASA, by support from RDC host institutions, and by fees from RDC clients. The outreach of RDC activities, particularly in the industrial sector, has been considerable, providing service to more than 3,000 clients.

Project management of the RDC's has universally been a NASA HQ TUO responsibility. Involvement of the NASA Field Centers in RDC activities has never been substantial, and only intermittent.

To maintain and increase the current RDC network growth impetus, two needs predominate. These are:

1) Expansion of the RDC network coverage and understanding of the technological needs of industry and, more particularly, state and local governments.

2) Facilitation of NASA Field Center technologists' association with RDC clients' wishes to find new applications for NASA technology or to modify it for use in problem solving.

This project plan outlines how this will be achieved.

Project Plan Summary

The project has three parts, namely:

1). Transfer from NASA HQ TUO to appropriate Field Centers responsibility for RDC contract management. This transfer of contract responsibility will:

- --Effectively use Field Center experience in contract responsibility and operational control.
- --Provide closer management overview and control of the RDC's because of the one-to-one relationship between a Field Center and an RDC.
- --Free NASA HQ TUO staff from day-to-day management responsibilities, thus making them available for planning, policy formulation, and coordination.
- --Establish a conceptual policy of linking sources of technology with its users.
- --Couple information services synergistically with information interpretation for increased utilization.
- --Enable Field Centers to develop a more pronounced regional exposure.

2) Creation of RDC divisional offices

The disadvantages of this transfer of contract responsibility to Field Centers will be offset by the proposed creation of RDC divisional offices in high density user regions and by new responsibilities and functions for NASA HQ TUO.

Some of these disadvantages are:

--diminished RDC network integration

--reduction in national visibility for the program as a whole

--no guarantee of improved efficiency of RDC operation

--decrease in the uniformity of RDC services even if their individual diversity may increase because of the Field Center association

It is believed that the effective RDC marketing radius of action cannot be more than 150 miles. Therefore, the effective marketing effort of parent RDC's will be increased by the establishment of RDC divisional offices in high density user areas within each RDC region. These will be located in:

--Atlanta, Georgia

--Houston, Texas

--Madison, Wisconsin,

--Denver, Colorado

--Salt Lake City, Utah

--Seattle, Washington

--San Francisco, California

The annual cost of each RDC divisional office is estimated to be in the order of $150,000. The benefits accruing are estimated to be:

- --an extension of each existing RDC operation in a cost effective manner
- --a potential for doubling the number of RDC client users
- --the creation of a basic structure for the market expansion of all TU products and services
- --a doubling of the ability to interact with state and local governments
- --an intensification of the effectiveness of addressing local and regional needs.

3) Diversifications of the Activities of NASA HQ TUO

By liberating NASA HQ TUO staff from the day-to-day management responsibilities for RDC's, that staff can turn its attention to activities on a national scale supportive of the RDC network as a whole. These will comprise:

- --small seminars for high level representatives of potential RDC clients
- --an intensification of contract and interaction with state and local governments together with relevant federal departments and the Federal Regional Councils

--a network and nation-wide corporate support and image building campaign which will involve:

--media advertising

--a series of network newsletters

--a series of articles on various aspects of the RDC program for newspapers and professions journals

--public service advertising on T.V. and radio

--a network brochure

--a coordinated and carefully planned program of public speeches

--the establishment of small business specialists at each of the RDC's and its divisional office, supported by appropriate inter-agency funds.

NASA HQ TUO will also be specifically concerned with:

--detailed definition of the RDC role and operating guidelines

--monitoring and evaluation of RDC performance and RDC Field Center interaction

--identification and central 'cataloging' of RDC and Field Center expertise

--coordination of marketing and problem solving assistance with large, national organizations and agencies--in both public and private sectors

--problem solving through network interaction, including compensation for support by RDC's to other RDC's

--Stimulation of industrial participation in public sector problem solving through regional and national meetings and conferences and high level NASA-industry interaction

--patent licensing assistance and coordination

--coordination with the federal government's decentralization regionalization activities, providing supporting functions through RDC's to each of the ten Federal Regions.

The degree to which the program expansion and integration can be successful will be determined by the RDC-Field Center relationship and the effectiveness of network coordination and management by NASA HQ TUO.

Costs: For this project, $2,000,000 per year will be sought, starting FY '76, in addition to normal RDC funding at $1,200,000 per year.

Manpower requirements: RDC and NASA HQ TUO manpower requirements will remain substantially the same as in the past. Each of the seven RDC divisional offices will be staffed by four people--exclusive of the small business specialists.

Procurement strategy: No new procurement strategies are intended for the existing RDC network, but RFP's will be issued for the establishment of the RDC divisional offices, preferably at suitable universities in the chosen areas. Procurement will be generally be initiated by the cognizant

Field Center with guidance from NASA HQ TUO.

Review and approval requirements: to be supplied later.

Major issues for management considerations: to be supplied later.

Project and Mission Objectives

This project is both intrinsically and extrinsically supportive of the mandate contained in the National Aeronautics and Space Act (as amended), Section 203 (a) (3) which states that the National Aeronautics, and Space Administration shall"...provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof." In particular, the objectives of the project are:

- --to double the present RDC's capacity for marketing their services
- --to double the current extent to which the RDC's existing data bases find utility
- --to accentuate NASA's identification with the RDC program and increase the general awareness of this by the public at large.

Related Studies and Activities

Earlier references to the merit of both the generalities and specifics of the over-all RDC project are legion. All RDC's submit annual reports of their activities. A breakdown of the earned income

performance of each individual RDC together with figures showing NASA's return on its investment in each RDC demonstrates a reassuring upward trend. A study of the RDC program published in 1971 recommended interalia that"...to make possible expanded coverage within each RDC's region, or alternatively, by establishing additional RDC's for this purpose."1/ Another recommendation was"...to provide services...to small business at proportionately lower charges..."2/ In a final comment the report states, "As increasing emphasis is put on technology transfer to benefit the public sector (emphasis added), action along the lines here recommended becomes increasingly important."3/

Observations and comments on the transfer process itself are numerous. Much concern has been shown about the role of personalized services in the process, which has a distinct bearing on the degree to which the generators of the technology (in this case, NASA Field Center personnel) must be associated with transfer efforts. In a report of work sponsored by NASA at the University of Maryland, it was stated that"...it is demonstrably evident that a critical point in the transfer and utilization mechanism is the personal confrontation of the intended user with the innovator.

1/ John Geise, "The Role of the Regional Dissemination Centers in NASA's Technology Utilization Program, "NASA Contractor Report CR-1763, May 1971, p. 70
2/ Ibid., p. 71
3/ Ibid., p. 71

Such a confrontation if skillfully managed and responsibly contributed to by all the parties generally transfers to and generates within the user that degree of emotive enthusiasm so psychologically necessary for embarking on a new endeavor characterized by educated guesses about immeasurable unknowns."[4/]

In short, therefore, this project seeks to implement the major recommendations of these and other studies sponsored by NASA.

Summary of Technical Plan

Highlights of the technical aspects of the project are:

-- RDC Information and Application Services

--determination of information resources

--the updating and expansion of information resources

--pre-search dialogues

--pricing (with marketing specialists)

--interpretation of client needs

--conversion of problem into proper search modes (e.g., computer, manual, personal)

--problem networking

4/ University of Maryland, "Final Report of 1964 Activities Relating to a Study Contract to Develop Dissemination Procedures for Use with Industrial Applications Program." NASA Contract NAS 5-3566. June, 1965, p. 260

--match-making

--post-search evaluation to determine relevance

--evaluation of application by "expert" (local or national)

--technical follow-up

--prototype definition and development

--user-design review

--repository for all TU products and services, e.g., NASA patents, Tech Briefs, Transfer Profiles, and special publications.

--RDC Marketing Functions

--price quotations

--initiation of contracts and development of leads

--marketing plan

--literature and advertising

--qualification of leads

--political ground rules and interaction

--marketing strategies

--sales goals

--identification of target areas

--follow-up (after provision of service)

--renewal

--examples of transfer cases

--definition of services provided

--training of salespeople

--proposal writing to cover contingencies relating to industrial property arising from work done for clients.

--RDC Computer operations

--develop and expand tape files

--program and format

--update and reformat

--develop search strategies

--schedule work priorities

--develop and update subject authority lists

--key punch

--operate TWIX and RECON

--RDC Management and Administrative Functions

--Field Center, NASA HQ TUO and host institution relationships

--interaction at the political and working level in all aspects of the public sector

--effective networking

--service diversification

--financial management

--joint ventures with the private and public sectors

--inter-agency agreements

--RDC Assistance to State and Local Governments

The RDC program has been heavily oriented during the past to provide technical problem solving assistance to the private industrial sector. As state and local governments are now confronting many problems whose solutions may require the application of new technology and its effective utilization, it is planned to initiate programs which will assist them in identifying technology intensive problems, provide technology for suggested solutions, and establish a continuing advisory relationship with the public sector user community. Pilot programs to date indicate that assistance in the use of management techniques, earth resources data for land planning, environmental impact, management of water resources and others, would be of special interest. As the inventory of photography from the Skylab and ERTS programs increases, accompanying computer programs for retrieval of data, modeling of problems, and reduction of data for specific applications will become extremely important to the public sector user community. The RDC's are presently organized to provide assistance to public sector organizations in the application of this as well as other new technology emerging from NASA research and development programs.

--RDC Small Business Program

Historically RDC industrial clients have been evenly divided between large and small businesses. The definition used for small business is a company employing fewer than 500 employees. The RDC small business clients tend to be closer to the 500 employee level than 100 or fewer. Usually special assistance is required to maximize the effectiveness of RDC services for the latter group of small companies. Supplying additional resources is planned for selected RDC's by providing a full time representative to work with this group of small companies. A considerable amount of NASA technology is of a very fundamental nature and could be of significant value to these companies. This plan would ensure that the Technology Utilization Program is concerned with a broad spectrum of the industrial community.

--RDC Industrial Seminars

It is proposed that six Technology Utilization Seminars be held during FY '76. Like seminars have already been held and have met with a good deal of success, eliciting favorable comment by those attending. The purpose of the seminar is to introduce a group of key industrial managers to NASA's TUO program and the role of the RDC's in providing technology transfer services. The meetings have been held in mid-western cities--Chicago, Detroit, Minneapolis--with large industrial or manufacturing bases. Prospective attendees will

generally be presidents, technical vice presidents or managers of R & D of the major companies in the areas. Each person is sent a personal invitation to the seminar and lunch for convenience to everyone attending. The invited group is restricted to 35 to 50 people to allow for an informal atmosphere and personal interaction among speakers and attendees. The program usually consists of a short informal talk by a NASA official about NASA's TU Program followed by a film and lunch. After lunch an RDC representative describes the various services and opportunities offered by the NASA program. Enough time is allowed for questions and general discussion. The meeting is then adjourned and attendees are encouraged to engage in further discussions with the NASA or RDC representatives. The Industrial Seminar has proven to be a cost effective mechanism to communicate directly with a chosen group of business executives, and has increased the visibility of the TU Program materially in the business community where the seminars have been held.

--RDC Advertising Program

It is proposed to plan and execute an integrated advertising program to increase the public's awareness of the RDC network. Although NASA has established a network of six RDC's located across the United States to provide assistance to industry in applying the results of federal research and development to the solution of industrial problems, nationally the business community is not much aware of this important

resource. An integrated, phased advertising program using a variety of media outlets coupled with other programs described above, will be used to increase industrial awareness and participation in capturing the return on the public's investment in NASA and other government generated technology.

--Benefits to the Public

A new program will be established to aggregate, integrate and report benefits ensuing to the public from NASA's research development programs. This continuing effort in identifying and reporting benefits would include programs managed by the TU Office as well as a continuous assessment of all NASA research, development and operational programs, such as the Space Shuttle, deep space probes, communication, environmental and geodetic satellite programs, and special activities in the fields of energy, earth resources data and environmental assessment and measurement.

Management Approach

Field Centers will have the prime RDC contract responsibility but NASA HQ TUO will provide detailed definition of the RDC and the RDC network role and mode of operation together will over-all operational guidelines. It is conceivable that a small *ex officio* group will be needed to function as a network coordination and service center, and also in an advisory capacity to NASA HQ TUO. This group will be supplemented from time to time by representatives of Field Centers, RDC's, and host institutions.

Procurement Strategy

NASA HQ TUO in coordination with NASA Field Center Directorates will establish the necessary funding levels for all RDC's and their divisional offices and will provide the Field Centers with the agreed-to funds at least four months before the due date for the contract commitment of such funds.

Project Schedule

It is not currently envisaged that the total RDC project will have a definite completion date since it is a continuing project serving the national interest, conceivably to be 'spun off' at some point as the basis for a broad federal program for technology transfer. Therefore, the schedule milestones herein referred to are addressed to the specifics of this project essentially aimed at maintaining and increasing the current RDC network growth impetus and its interaction with the technology intensive public sector needs.

Transfer of RDC contract management responsibilities to NASA Field Centers:

RDC	Transfer Date	Field Center
NERAC	7-1-74	Goddard
NCSTRC	11-1-74	Langley
WESRAC	2-1-75	Ames

RDC	Transfer Date	Field Center
TAC	7-1-75	Johnson
KASC	9-1-75	Lewis
ARAC	10-1-75	Lewis

Creation of RDC Divisional Offices

Initiation date: July 1975 Target completion date: June 1976

Diversification of NASA HQ TUO Activities

Initiation date July 1975 Target completion date: June 1976

The over-all target of doublingthe number of RDC clients over and above the current baseline is expected to be achieved by December, 1976.

Resources Plan

The following annual costs are estimated to be the minimum necessary for successful implementation of this project:

RDC operations	$1,200,000
RDC divisional offices	1,050,000
NASA HQ TUO diversification	950,000
TOTAL	$3,200,000

It is further estimated that the return from the RDC network on this NASA investment will be, over-all, on the order of $2,000,000 in the first year.

Management Review

Management reviews of the progress and success of the implementation of the project will occur at quarterly intervals on the basis of reports submitted to Field Centers and NASA HQ TUO by RDC's. Management review data required will consist of:

Monthly program management reports

These reports in letter form will contain transfer information. Negative reports will also be made as well as accounts of emerging transfer which will continue to be monitored and reported on until they mature. These reports will also form the basis for the annual cumulative transfer report due December 15th for the current calendar year.

Quarterly program management reports

Items to be included will be:

--earned income for the period

--number of clients using more than $50 in services, including annual clients

--number of clients using less than $50 in services

--number of documents sold, including satellite photographs and computer programs

--a breakdown for each salesperson of visits and sales during the period and the number of new clients or renewals obtained

--the percentage of the total operating budget allocated to marketing during the period

--any significant new marketing campaigns, operational or planned

--problem areas, e.g., network services, host institutions, client relationships, any services to the RDC's. Problems requiring NASA attention and action should be so designated.

Within 30 days after receipt by NASA HQ TUO of all RDC quarterly program management reports, NASA HQ TUO will provide each RDC director and Field Center Management with a summary of network performance during that quarter, with client incomes, names of clients, problems posed and solved, and any new actions and initiatives taken or contemplated by NASA HQ TUO.

Annual (CY) program management reports

Items to be included for the previous and current calendar year will be:

--total number of organizations served

--earned income generated (in thousands of dollars) for each quarter

--breakdown of users into industrial, governmental, university, and other

--breakdown of industrial users by size: large (500 and more employees); small (fewer than 500 employees).

In addition, a list of the calendar year clients in alphabetical order will be required in two sections, one containing clients using more than $50 in services, and the other section containing clients using less than $50 in services. Each section will have four headings: searches, documents, computer programs, and photographs. If a client buys a search and subsequently some documents both columns will be checked.

Controlled Items

1) location of and key personnel at the RDC's and the RDC divisional offices
2) level of effort agreed necessary to sell the RDC service
3) level of effort agreed necessary for RDC's to provide service to their primary targets--the regional private and public sectors
4) the extent and diversity of the RDC network's information data bases
5) NASA HQ TUO reporting requirements
6) minimum levels of annual RDC client income
7) areas of legitimate RDC service diversification.